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ABSTRACT

Developed for use in the automotive mechanics program at Brooklyn High School in the Cleveland suburbs, this course of study is presented as an example of an application of the instructional systems design (ISD) process. Introductory material includes school and program philosophy statements and a general description of the program, which is designed to give the student, over a two-year period, 1,620 hours of practical training in manipulative activities and related technology so that he can acquire a job as an automobile mechanic advanced learner. Instructional program strategies (group and individual demonstrations, audio and visual presentations, and field trips) are discussed along with procedures for the daily laboratory and class routine. Major content of the guide consists of a course outline divided into junior and senior class sections. A topical listing of the course content is followed by a complete instructional schedule. In the laboratory component content is arranged in instructional groups that include objectives, content, notes, and suggested management, instructional, and evaluation strategies. Where rotation of students through specific learning activities is required, a rotation schedule is included. The related technology component is sequenced by instructional days over the entire two-year period. Appendixes include samples of lesson plans, assignment sheets, work sheets, information sheets, tests, and work request forms. (JT)

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COURSE OF STUDY
VOCATIONAL AUTO MECHANICS
GRADES ELEVEN AND TWELVE

By

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Automotive Department

Brooklyn High School

Brooklyn, Ohio

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

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FOREWORD

Sound courses of study are the backbone to quality vocational education programs. Courses of study provide teachers with a detailed roadmap regarding what to teach, when to teach it, and the major policy, environmental and tactical considerations that must be taken into account to insure effective instruction.

During the past year a concerted effort has been made across Ohio to stimulate the improvement of courses of study in vocational education. Intensive in-service training activities have been conducted involving state and local vocational education leadership personnel to instruct them in a systems approach to instructional design. The instructional systems design (ISD) process provides a logical and educationally sound approach to planning for and conducting vocational educational programs that will result in students obtaining meaningful employment while gaining a purposeful education.

This course of study is a result of the application of the ISD process. It was developed and is being used by its authors. The document embraces those components essential to good instructional planning. It must be emphasized, however, that it is only an example; not a model that is to be universally adopted. It has been designed specifically for the school and community setting which it serves and is intended to serve only as an illustration of how the ISD process can be employed.

Vocational education in Ohio is indebted to the authors and consultants associated with the development of this course of study document. As a result of their professional involvement and contributions, vocational education continues its thrust to better serve statewide and local economic, societal and individual needs and interests.

Byrl R. Shoemaker
Director
Vocational Education

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GLOSSARY OF TERMS

1. Activity - A very specific level in the hierarchy of a job. The activity is the smallest aspect of a skill, i.e., Job-Duty-Task-Step-Activity.

2. Behavioral Objective - A statement of instructional goals expressed in observable and measurable terms. Such a statement includes the behavior, the conditions, and the standard of acceptable performance.

3. Course Outline - A topical listing of the content of a specific course.

4. Course of Study - A comprehensive and detailed plan which shows the scope and sequence of content, and the organization and management of all instructional activities for a specific course in the curriculum.

5. Duty - (Block) - A large segment of an occupation made up of related tasks.

6. Evaluation Strategies - Methods of determining the success of an instructional process including the necessary planning to insure the accurate appraisal of learner achievement in relation to behavioral objectives.

7. Formative Evaluation - An appraisal process designed to determine if a student is progressing satisfactorily; if, in fact, he understands what is being presented during the presentation/demonstration phase.

8. Instructional Grouping - A series of tasks grouped together, organized for instructional purposes, and place in a general time frame.

9. Job - The composite of tasks or competencies which comprise the manipulative activities performed by an individual.

10. Lesson Plan - A detailed teaching breakdown of the important points of a lesson arranged in the order in which they are to be presented. A lesson plan is a step by step analysis of how one intends to develop a lesson.

11. Management Strategies - Methods of organizing and manipulating instructional facilities, equipment, materials, students and time.

12. Module - A natural subdivision of a group of tasks or competencies and composed of lessons that would logically be taught in close sequence.

13. Rotation - A process employed by a teacher which assures that all students have the opportunity to develop skills and gain experiences in all phases of an educational program on an organized basis.

14. Skill - (Operation) - A manipulative action performed while producing a finished product.

15. Step - level within the hierarchy of a job, i.e., Job-Duty-Task-Step-Activity.

16. Task - (Skill or Occupation) - A unit of work performed in the completion of an assigned job, i.e., Job-Duty-Task-Step-Activity.

17. Teaching Strategies - Methods of directing and conducting the process of instruction in a given situation.

18. Coding to Occupational Analysis - In both the course outline and course content, the reader will find a letter and number code after each major instructional grouping. This will indicate a direct reference to the corresponding task statement for both laboratory and related areas in the State Occupational Analysis. This course of study includes those general task statements and is supplemented by information supplied by the Advisory Committee and the instructors' own field experience.

THE EDUCATIONAL PHILOSOPHY OF BROOKLYN HIGH SCHOOL

The Brooklyn High School seeks to guide the development of the whole pupil; mentally, physically, socially, morally and emotionally. The curriculum is to meet the needs of the pupils and the community using pupil experiences as much as possible in developing a democratic way of life.

THE SPECIFIC EDUCATIONAL OBJECTIVES

1. To provide an environment conducive to normal mental, physical and moral development.

2. To provide through this environment competent leadership in developing and following skills and concepts.

    A. SKILL IN HUMAN RELATIONS

    Skill in human relations means developing the ability of living and working with others, amicably and productively, with a willingness to accept inherent individual differences.

    B. EFFECTIVE COMMUNICATION

    Communication is the reflection of our personalities. The effectiveness of our intelligence and ability can be impeded by the inadequacy of oral and written communication. Speech includes clarity of expression, choice of words, development of ideas, and dramatic expression.

    C. EFFECTIVE READING

    Reading is basic to all facets of education. Continuation of education beyond its formal phase depends upon effectiveness of reading, which hinges on comprehension and speed. Effective reading is important throughout one's life.

    D. CRITICAL THINKING

    Critical thinking is developed through an objective exploration of various fields of knowledge. Such exploration and inquiry using inductive and deductive techniques resulting in judgment, decision making and commitment are of paramount importance and accomplishes a reduction of pre-conception and prejudice.

    E. APPRECIATION OF AND AN AWARENESS OF AESTHETICS

    Beauty is all inclusive. It abounds in the physical as well as the aesthetic; it can be found in literature as well as in music, in homemaking as well as in art and in all areas of school life.

F. RESPECT FOR THE RIGHTS AND PROPERTY OF OTHERS

The effectiveness of a democracy is dependent upon the individual's self-awareness, his integrity and the realization of his potential. Rights involve certain obligations and responsibilities. The objective to provide the conditions which will encourage self-direction on the part of the student as he matures in order that he may live meaningfully and responsibly in a democratic society.

G. APPRECIATION, UNDERSTANDING, AND RESPECT FOR OUR BASIC INSTITUTIONS

The family is an institution in which the individual is nurtured and realizes a large measure of growth. The family and school instill the individual's basic set of life values, the mores of the larger community and establish the basic conceptual structures of morality and ethics. These basic institutions require appreciation and support as part of our educational roles.

H. SKILL IN ATTAINING ECONOMIC COMPETENCY

Since economic competency is necessary to the American way of life, it is important that each pupil form habits, attitudes, desires and appreciations through solving economic problems, meeting economic situations and developing vocational skills.

I. PROPER USE OF LEISURE TIME

Worthwhile leisure time activities go far toward relieving the strains of present-day living. These individually satisfying activities are to be realized through the appreciation of the fine arts, an understanding of mass culture, participation in physically recreative activities and the development of interests which can be continued beyond high school.

J. APPRECIATION OF OUR COUNTRY'S CULTURE.

Each of the various cultural groups represented in the community has a distinct contribution of value in terms of fine arts, mores, and folkways. There is also a contribution in terms of religious, economic and political concepts which has resulted in our present way of life. This, we feel, needs to be integrated with our overall American culture.

VOCATIONAL EDUCATIONAL PHILOSOPHY
OF
BROOKLYN HIGH SCHOOL

We accept individual students as they are and try to meet their individual needs through individualizing the curriculum. Therefore, the curriculum should always be changing to keep pace with the present trends in social economic changes that affect our society. This curriculum should preserve and foster a democratic way of life.

It is our aim to provide an environment which will enable students to develop saleable skills and concepts, foster and promote ideals and goals that will lead to an enjoyable, fulfilling life. We want to be able to place every student in his or her vocational area of work or study upon graduation. Students in vocational education will be taught:

1. to demonstrate pride and good workmanship
2. to be able to read, understand, and communicate (orally and in writing) the technical terms related to their vocational areas
3. to demonstrate self-control and self-reliance
4. to solve the technical problems relative to their chosen vocational areas
5. to identify the various job opportunities available in their vocational areas
6. to be able to demonstrate their manipulative skills
7. to be able to operate the various machines and equipment related to their vocations
8. to be able to identify the marks of a good employer and employee
9. to list the various safety standards in their areas
10. to apply the technical skills to the manipulative skills.

PROGRAM PHILOSOPHY

The growth and progress of the United States has been predicated on its transportation facilities. These facilities, whether land, sea or air, for commerce or recreation, use some form of internal combustion engines. These numbers of vehicles and their power plants will require some form of service during their lifetime.

With this huge field, there will be a large number of mechanics required to perform service and repair operations. These mechanics will need skills (and technical knowledge) as well as honesty, pride, and integrity to perform successfully in the automotive trades.

We believe Vocational Automobile Mechanics should fulfill the needs of our students, and the requirements of the community.

Because of this ever-growing need for good automobile mechanics, this program should help fulfill that need by producing qualified young people who possess the essential entry level skills to enter this trade area.

The related technology and shop experience in this vocational program should cause the student to develop safe and mature working habits. The time spent in the trade area should provide the opportunity to develop the manipulative skills and the knowledge necessary to go to work in any area of the trade as an advanced learner.

The community should also benefit because of the quality of automobile mechanics provided through this vocational program.

PROGRAM OBJECTIVES

The program objectives for Auto Mechanics at Brooklyn High School are as follows:

The student will be able to perform each duty included in the instructional program at an occupational entry level as an advanced learner, in accordance with industry approved automotive mechanics standards of practice and performance common to independent or dealership garages.

Each student will be able to demonstrate a knowledge of automotive nomenclature, technical information, procedural steps, and principles of mathematics and science, by means of the written and oral communications required in the maintenance and repair of automotive units under actual trade conditions. Students will demonstrate their ability to apply such knowledge and understanding within the laboratory in accomplishing the assigned laboratory tasks.

The student will exhibit mature and safe working habits, as compared to those in industry, while being observed in the shop.

The student will exhibit an appreciation for the correct use and care of the tools and equipment of the trade.

The student will demonstrate the ability to analyze the value of mechanical design and the execution of the various automotive elements by examination in both technology and manipulative areas.

The student will demonstrate a mature and responsible attitude toward automotive mechanics while studying the trade by demonstrating skill, honesty and integrity in making safe, reliable and economical repairs to customer automobiles.

INTRODUCTORY STATEMENT

The Automotive Mechanics Program at Brooklyn High School is designed to give the student, over a two-year period of time, 1620 hours of practical training in the automotive trade area. At the successful completion of these two years, the student will have received enough training in manipulative activities and related technology to acquire a job as an automobile mechanic advanced learner.

The content for this course of study is based on the existing State Occupational Task Analysis for Automobile Mechanics, as presented by the Instructional Materials Laboratory for the State of Ohio. It has been further supplemented by the Brooklyn High School Auto Mechanics Advisory Committee.

Brooklyn is a small suburb located in the southwest portion of Greater Cleveland, and is populated, to a large extent, by first and second generation semi-skilled and skilled blue collar workers. The high school enrollment is presently 802 students in grades 9 - 12. Sixty-three (63) percent of the 11th and 12th grade students are currently enrolled in vocational programs, with thirty-eight (38) percent of those students enrolled in Trade and Industrial Programs. The Trade and Industrial curriculum includes two-year programs in Automotive Mechanics, Cosmetology, Industrial Electronics, Machine Trades, and Occupational Work Experience.

The Automotive Shop, located in the vocational wing, is a drive-through area, allowing easy access for entrance and exit of vehicles and supplies. The overall dimensions of the shop are 95 feet by 60 feet. There are accommodations for ten live automobiles, plus floor space for a chassis dynamometer and a 32 feet by 18 feet wire caged area for stand-mounted multi-cylinder engines. One end of the shop has three 20 feet by 13 feet sections for lockers and wash-up, instructors' office, and toolroom and storage area. A mezzanine above these sections is used as an automotive machine shop and engine assembly area. The shop has a center drain, in-floor exhaust system, three hydraulic lifts, overhead reel lights, electrical and air outlets for each stall.

In addition to the shop area, an outside fenced-in security area provides for storage of twenty vehicles.

The equipment available in the automotive shop is as follows:

Floor jacks (4)

Portable hydraulic hoist

Bench grinder

Engine grinder

Engine scope

Oxygen - acetylene torch

Electric arc welder

Safety stands (14)

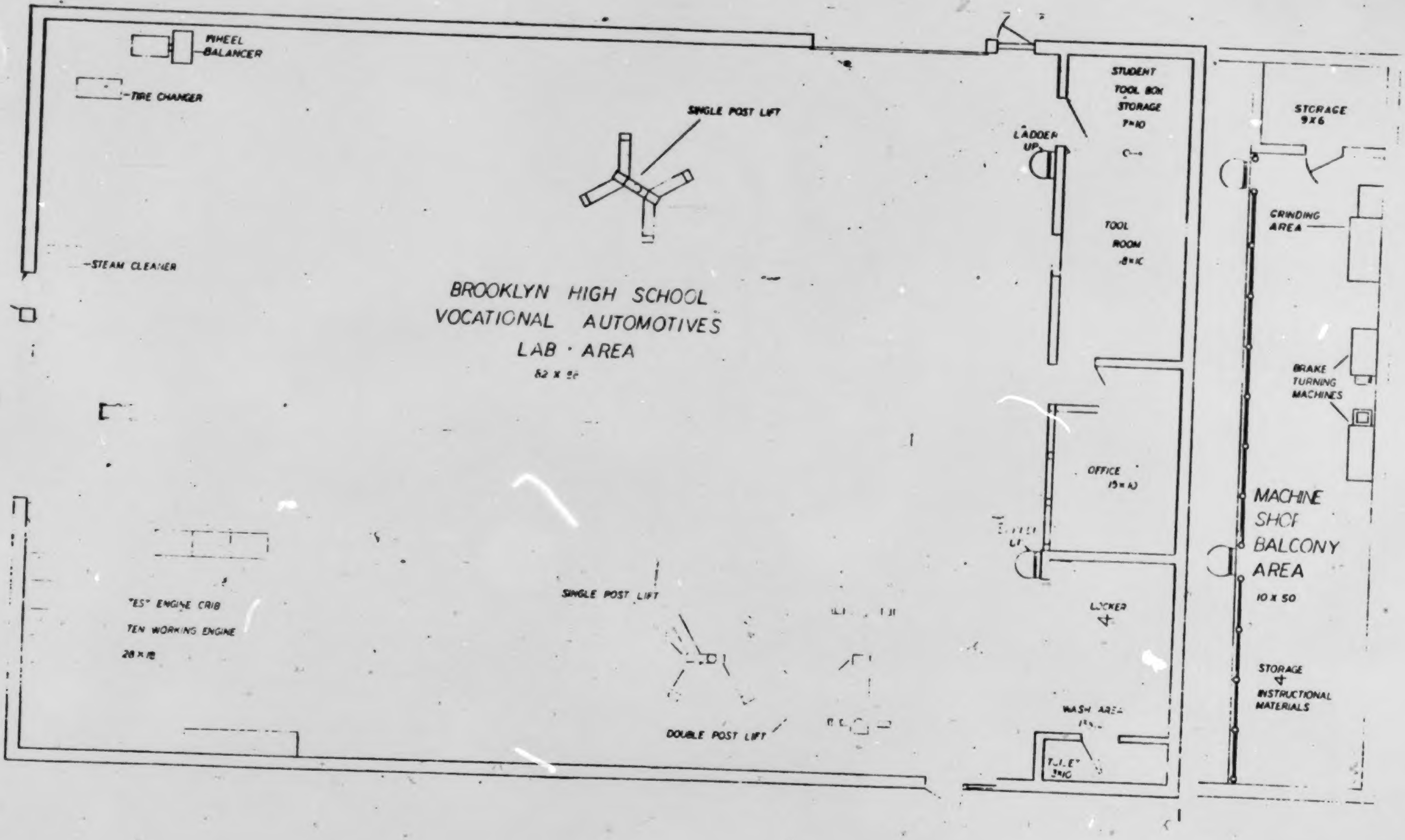
Steam cleaner

Portable front end machines (2)

Bench distributor tester
Parts solvent tank
Tire changer
Tire balancer
Transmission jacks (2)
Oil drain container
Lubrication equipment
Gear oil dispenser
Spark plug cleaner
Hydraulic press
Valve grinder
Valve seat grinder
Air conditioning repair equipment
Brake drum lathes (2)
Infrared exhaust gas analyzer
Electric chain fall
Portable electrical tune-up equipment
Specialized job hand tools (1,000)
Shop manuals
Air compressor (5 1/2 H.P.)
Creepers (10)
Work bench cabinets (10)
Air hoses (15)

A deparate 24' x 24' classroom is provided for related instruction. The classroom has adequate storage for audio visual aids and is used exclusively for automotive classes.

The automotive shop and classroom facilities are shared by both the junior and senior classes, but not concurrently. The senior class utilizes the shop on a morning schedule and the junior class during the afternoon.


WHEEL BALANCER
TIRE CHANGER
SINGLE POST LIFT
STEAM CLEANER
BROOKLYN HIGH SCHOOL
VOCATIONAL AUTOMOTIVES
LAB · AREA
82 x 56
STUDENT TOOL BOX STORAGE 7x10
LADDER UP
TOOL ROOM 18x10
STORAGE 9x6
GRINDING AREA
BRAKE TURNING MACHINES
OFFICE 15x10
LADDER UP
LOCKER
WASH AREA
TOILET 3x10
MACHINE SHOP BALCONY AREA
10 X 50
STORAGE & INSTRUCTIONAL MATERIALS
"TEST" ENGINE CRIB
TEN WORKING ENGINE
28 x 18
SINGLE POST LIFT
DOUBLE POST LIFT

INSTRUCTIONAL PROGRAM STRATEGIES

The Auto Mechanics program is organized so that the task groups will be presented in a logical sequence over a two-year period. This sequence is arrayed in detail in the Task Sequence and the Course Content sections of this course of study.

The Junior year is a basic introduction to the automotive principles and familiarization of the use of tools and maintenance procedures. In the Senior year, the students are allowed some freedom to choose jobs - thus allowing for individual preference and specialization, and providing depth and refinement in the field.

The methods for presenting the task-oriented part of the curriculum are as follows:

1. Group and individual demonstrations
2. Audio and Visual presentations
3. Field trips

The exact method of presentation for each task group is specified in the Course Content of this document.

The students will be organized for actual practice of the tasks according to the task group being presented. The methods used will be as follows:

1. Individual students doing individual activities of an instructional grouping.
2. Individual students on modular assignments of instructional grouping.
3. Teams of two students assigned to individual activities of an instructional grouping.
4. Teams of two students on modular assignments of instructional groupings.
5. Those students who have demonstrated proficiency after March 1, of the senior year may be placed in jobs related to their field of instruction during their normal class time.

The method practiced for each task group is stipulated in the Course Content.

Each student will keep an organized notebook containing information sheets provided for classroom and manipulative instructional units as well as notes taken by the student in class sessions. Notebooks will be reviewed by the instructor for grading purposes. Evaluation of each notebook shall include:

Neatness
Accuracy
Completeness

(SEE APPENDIX FOR EXAMPLES OF INFORMATION AND ASSIGNMENT SHEETS).

Junior class students have available to them ten "live" engines in the Engine Overhaul area. In addition, ten inexpensive vehicles, which are school owned, are used for the expressed purpose of Auto Mechanics instruction. Parts and materials for these units are purchased and delivered as required from the local parts warehouse through a budgetary account.

Senior class practical work is solicited through the use of work requisitions circulated amoung the students, faculty and community. The parts and materials are charged to the customer and paid at the Vocational Office at the completion of the repairs. These work requisitions are analyzed and sequenced to the proper order to control the flow of the duties to be performed. This method has usually produced a two-month backlog of desired duties for the various service areas of the shop. Additional work can be solicited from automobile used car dealers, and by making use of the school owned vehicles.

Individual differences will be handled in several ways:

1. Slower students will be assigned jobs to insure their success.

2. Slower students will be assigned to work with more advanced students.

3. Individual instruction and after school tutoring.

4. Progress charts which allow a student to advance at his own speed.

Parts and materials are provided and delivered by use of a monthly purchase order to the local parts warehouse.

An additional monthly purchase order is provided for materials and supplies used for the maintenance and operation of the shop. This includes wiping towels, floor soap, oil absorption materials, etc.

The organization of this program provides for one and one-half hours per day of related instruction, and three hours per day of shop practice for each class. The related time allotted is used, in large part, to coordinate the related technology necessary for completing the tasks required during the shop experiences.

Upon entry into the Automotive mechanics program, the student is required to purchase the small hand tools and safety glasses necessary to comply with the program took inventory. Upon entry into the Senior phase of instruction, the student is required to purchase additional small tools necessary for the more advanced duties. These tool lists may be examined in the Appendix of this document.

The more specialized tools and equipment necessary are supplied from the shop tool room.

Formative evaluation for related technology is achieved by a series of quizzes, tests and examinations that are both oral and written and presented in the classroom. Formative evaluation for each task group is achieved by the methods listed in the course content. This provides immediate feedback which allows the instructor to modify the teaching as the outcome of these evaluations dictates.

An intermediate summative evaluation is provided by a comprehensive State examination administered each year. A further intermediate summative evaluation is provided by a customer evaluation sheet for each duty completed.

A summative evaluation for the two-year program is secured through initial job placement data and a follow-up study of past students still employed in the automotive industry two years after completing program requirements.

The school policies on grading are followed when determining auto students' grades on their ability to meet industry required standards for task groups, and also their achievement on related tests and quizzes.

DAILY LABORATORY ROUTINE:

The Auto Shop is organized to give the students indepth practical experiences in a controlled environment. The specific modules are arranged into various areas, each one similar to a type of production shop.

While effort is made to keep them separate, there is and must be some overlapping. While a team is assigned to brakes, they might also do some suspension work. The time frames for the duties are also flexible so that a team might advance very quickly through the brakes and require more time in the service and diagnosis section.

It may also be true that the slower students may require more time in lube services and will have less exposure in the more difficult tune-up and electrical module. The instructor must make careful considerations when assigning teams to the various modules so that students will not be working beyond their capabilities. For instance, those with limited literary skills and verbal communications may be withheld from the Service Desk duty and may spend more time in some of the other modules.

The same teams should not be allowed to progress through the complete course together, as one of the other members will suffer from the lack of, or the exercise of leadership ability. In instances when space permits, students should be assigned on an individual basis and returned to team status when the task is completed.

In order to assure the general safety and welfare of the student as well as develop safe work habits and attitudes acceptable to industry standards, the following safety rules and practices are applicable to all laboratory activities:

1. Only the proper cleaning solvents will be used to clean parts. Gasoline is never used.
2. Jack stands must be used before getting under a car when it is jacked up.
3. Safety glasses must be worn at all times, as prescribed by the State law.
4. Colored safety goggles must be worn when using the gas welding and cutting equipment. No student may use this equipment without first obtaining verbal permission from the instructor.
5. A safety helmet must be worn when arc welding.
6. An engine must never be started without the exhaust hoses properly in place.
7. Jewelry and loose clothing is not permitted in the shop.
8. Long hair must be tied back.
9. Hardsole shoes must be worn at all times.
10. Proper work clothes must be worn at all times.
11. All power and electrical equipment must be shut off before leaving it.
12. There is to be no unnecessary noise of any kind - including shouting or playing radios.
13. When working with another student, never turn an engine on until you are sure the other person is clear.
14. The floor will be kept clear of light cords, air hoses, tools or equipment not in use.
15. No student will leave the premises with an automobile.
16. Dynamometer checks must be personally supervised by the instructor.
17. All students must have a working knowledge in the use of fire extinguishers and fire blankets.
18. Absolutely no horse play.

As a means of providing all students the opportunity to development all skills set forth in the course of study, and to assure effective and efficient laboratory facility and equipment utilization and control, the following student personnel management system is in accordance with the appropriate rotation schedule/s.

A. Shop Foreman

1. Write repair order for each car coming into the shop.
2. See that all parts used on the job are listed on the repair order.
3. Final check of repair orders on completed jobs.
4. Check work areas to see that they are properly cleaned at the end of the class.
5. Assign students for specific clean-up duties when their own work areas are completed. This is achieved with the use of a rotation chart.

B. Tool Room Attendant

1. Answer the telephone.
2. Issue tools to students and maintain a record of which student has tool.
3. Keep tool room clean and orderly.
4. See that any parts or supplies issued from the tool room are charged out on a repair order.
5. Order parts from the warehouse.
6. Check parts received from the warehouse.
7. Inform instructor of any broken or missing tools and any required supplies or parts.

Because of the nature of the program, the Junior class will have only a tool room attendant who will also perform the duties of the shop foreman.

In addition to the shop foreman and tool room attendant responsibilities, each student will rotate through all skill development and practice activities in accordance with the laboratory schedule of instruction.

Daily Class Routine:

The students are required to line up on the auto shop center grate, five minutes after the tardy bell. They will be dressed in proper work clothes, have their tools beside them, and safety glasses on.

A brief discussion of the day's work assignments will follow attendance. If there is to be a general class demonstration, it will be presented at this time. If not, the class will go to their individual work stations and begin the day's operations.

Clean up begins fifteen minutes before the end of class. All cars for delivery, cars to remain overnight, or school owned vehicles, are moved outside to the fenced in area - thus allowing ample room for the next class. Students will clean their own work areas and specified units each day.

The day's work problems are discussed in the related classroom. Following this discussion, a related lesson will begin with visual, audio-visual, or chalkboard aids. Quizzes for tests are given on a regular basis, allowing for formative evaluations.

AUTO MECHANICS
COURSE OUTLINE

The following course outline is a two-year outline, developed by the automotive mechanic instructors and based, in large part, upon an automotive mechanics occupational analysis as well as the input from a local advisory committee.

It will be noted that the outline has been divided into junior and senior class components to facilitate the organization and scheduling of laboratory and related instructional activities.

COURSE OUTLINE FOR JUNIOR AUTOMOTIVE

Orientation and Basic Operations

1. Safety regulations
2. Shop tour
3. Locker assignments
4. Tool distribution and registration
5. Personnel system
6. Cleaning procedure
7. Progress chart
8. Daily procedure
9. Engine assignments
10. Use of fire extinguishers
11. Use of lifts
12. Use of jacks
13. Electrical outlets
14. Power switches
15. Exhaust system
16. Demonstration (engine disassembly)

Engine Disassembly (F-2)

1. Drain oil
2. Remove filter
3. Remove rocker covers
4. Remove carburetor
5. Remove intake manifold
6. Remove rocker arms or rocker shaft
7. Remove pushrods

8. Remove valve lifters
9. Remove cylinder heads
10. Remove fan and shroud
11. Remove radiator
12. Remove water pump
13. Remove harmonic balancer
14. Remove timing cover
15. Remove timing chain and gear
16. Remove crankshaft sprocket
17. Remove distributor
18. Remove camshaft
19. Remove engine from stand
20. Remove oil pan
21. Remove oil pump
22. Remove cylinder ridge
23. Remove rod caps
24. Remove pistons
25. Remove piston rings
26. Remove main bearing caps
27. Remove crankshaft

Engine Cleaning (F-2)

1. Clean rocker covers
2. Clean exterior of carburetor
3. Clean intake manifold
4. Clean and polish rocker arms or rocker shaft
5. Clean pushrods
6. Clean lifters

7. Clean cylinder heads
8. Clean water pump
9. Clean harmonic balancer
10. Clean timing cover
11. Clean timing chain
12. Clean timing gear
13. Clean crankshaft sprocket
14. Clean distributor
15. Clean camshaft
16. Clean oil pan
17. Clean oil pump
18. Clean pistons
19. Clean ring grooves
20. Clean connecting rods
21. Clean crankshaft
22. Clean block

Engine Analysis (F-4)

1. Measure bore
2. Measure taper
3. Measure compression ring gap
4. Measure oil ring gap
5. Measure compression ring clearance
6. Measure oil ring clearance
7. Measure cylinder head warpage
8. Measure valve guide clearance
9. Measure valve stem wear
10. Measure valve head clearance

11. Measure camshaft lift
12. Measure camshaft end play
13. Measure crankshaft end play
14. Measure crankshaft rod journals
15. Measure crankshaft main journals
16. Measure wrist pin wear
17. Measure piston heads
18. Measure piston skirts
19. Measure bearing clearances.

Servicing Engine Block Assemblies (F-3)

1. Boil engine block
2. Hone cylinders
3. Insert camshaft
4. Fit piston pins
5. Recondition pistons
6. Recondition rods
7. Recondition crankshaft
8. Fit insert bearings
9. Fit piston rings
10. Install pistons
11. Torque crankshaft to specifications
12. Torque rods to specifications
13. Insert rear main bearing seal
14. Install oil pump
15. Install oil pan
16. Install camshaft
17. Install timing gears and chain

18. Install front crankshaft seal
19. Install timing cover
20. Install lifters
21. Grind valves
22. Insert valves
23. Mount cylinder heads
24. Install pushrods
25. Install rockershaft assembly
26. Mount intake manifold
27. Install carburetor
28. Mount rocker covers
29. Install distributor

Engine Starting (H-2)

1. Install oil
2. Install coolant
3. Install transmission fluid
4. Hook up fuel system
5. Install plug wires
6. Install spark plugs
7. Hook up ignition switch
8. Wite primary circuit
9. Hook up battery
10. Hook up starting circuit
11. Hook up exhaust system
12. Prime carburetor
13. Start engine

Engine Installation (F-2)

1. Remove drive shaft
2. Disconnect speedometer
3. Disconnect transmission linkage
4. Disconnect clutch linkage
5. Remove starter
6. Remove transmission
7. Remove exhaust system
8. Drain cooling system
9. Disconnect heater hoses
10. Disconnect vacuum lines
11. Disconnect carburetor linkage
12. Remove power steering pump
13. Remove alternator
14. Remove air conditioning
15. Remove all electrical leads
16. Remove motor mount through bolts
17. Remove engine
18. Clean engine
19. Reverse tasks 1 - 17
20. Start engine
21. Test systems

Ignition System Analysis (F-1)

1. Take compression test
2. Take leak down test
3. Inspect spark plugs
4. Set timing with a vacuum guage

5. Set timing with a timing light
6. Set dwell with a feeler guage
7. Set dwell with a dwell meter
8. Adjust carburetor with a tachometer
9. Determine firing order
10. Remove and replace distributor

Repairing Ignition Systems (H-2)

1. Remove plug wires
2. Determine plug size
3. Inspect new plugs
4. Service used plugs
5. Gap plugs
6. Replace plug wires
7. Remove and replace coil
8. Test primary windings
9. Test secondary windings
10. Determine distributor advance curve
11. Remove and replace points
12. Check point resistance
13. Check point tension
14. Check condenser
15. Check primary voltage
16. Disassemble distributor
17. Assemble distributor to specifications
18. Time engine
19. Scope test ignition
20. Set engine to standards by use of an infrared

Repairing Cranking Motors (P-1)

1. Perform cranking system voltage and amperage tests
2. Remove and replace cranking motors
3. Overhaul a General Motors starter
4. Overhaul a Chyrsler Corp. starter
5. Overhaul a Ford Motor starter
6. Test starting components for malfunctions

Repairing Generators (P-2)

1. Measure generator voltage output
2. Measure amperage output
3. Measure resistance
4. Measure capacity
5. Perform growler test
6. Perform resistance test
7. Perform open circuit test
8. Perform generator output test
9. Remove and replace generator
10. Replace generator brushes
11. Replace generator armature
12. Replace generator field coil
13. Replace generator end plate bearings
14. Service generator

Repairing A/C Units (P-1)

1. Remove and replace alternator
2. Measure alternator voltage output
3. Measure alternator amperage output
4. Measure alternator resistance

5. Measure alternator capacity
6. Perform alternator resistance tests
7. Perform alternator open circuit tests
8. Perform alternator output tests
9. Replace alternator brushes
10. Replace alternator rotor
11. Replace alternator windings
12. Test and replace alternator diodes
13. Replace alternator bearings
14. Service alternator

Repairing Regulators (P-2)

1. Remove and replace regulator
2. Test current regulator
3. Test voltage regulator
4. Test cutout regulator
5. Adjust current regulator
6. Adjust voltage regulator
7. Adjust cutout regulator
8. Test internal regulators

Testing Circuitry (P-1)

1. Test for draw on battery
2. Test for voltage drop
3. Test for amperage draw
4. Test for shorted circuit
5. Locate draw on battery
6. Locate short circuit

Servicing and Repairing Fuel Systems (E-1-2)

1. Remove fuel
2. Remove fuel tank
3. Remove fuel guage
4. Test fuel guage
5. Repair fuel guage
6. Replace fuel tank
7. Test for leaks
8. Test fuel guage for accuracy
9. Vacuum test pump
10. Pressure test pump
11. Remove pump
12. Replace diaphram
13. Replace pump
14. Remove air cleaner
15. Service heat doors
16. Service linkage
17. Test heat sensor
18. Replace air cleaner
19. Test for vacuum leaks
20. Remove carburetor
21. Dismantle carburetor
22. Clean carburetor
23. Overhaul carburetor
24. Adjust to specifications
25. Install carburetor
26. Adjust air-fuel ratio

27. Adjust engine idle
28. Remove exhaust pipe
29. Remove heat riser
30. Remove exhaust manifold
31. Replace gaskets
32. Remove and replace tail pipe
33. Remove and replace muffler
34. Remove and replace catalytic converter
35. Service PCV system
36. Test PCV Valve
37. Check diverter valve
38. Remove and replace A.I.R. pump
39. Check operation of check valve
40. Remove and replace belts
41. Replace evaporative filters
42. Calibrate infrared equipment
43. Analyze hydrocarbons
44. Analyze carbon monoxide
45. Adjust to specifications

Servicing and Repairing Cooling Systems (D-1-2)

1. Remove cap
2. Fill reservoir
3. Pressure test
4. Check temperature
5. Analyze protection
6. Service cooling system
7. Replace radiator
8. Replace radiator

9. Replace expansion plug
10. Replace thermostat
11. Replace heater hoses
12. Replace radiator hoses
13. Replace heater core

Servicing and Repairing Braking Systems (Mechanical)(I-1)(J-1)

1. Remove front drums
2. Remove rear drums
3. Repack front bearings
4. Turn drums
5. Grind drums
6. Resurface rotors
7. Remove brake shoes
8. Test springs
9. Service self-adjusters
10. Install new shoes
11. Replace drums
12. Service parking brake
13. Adjust brakes

Servicing and Repairing Braking Systems (Hydraulic)(I-1)(J-1)

1. Remove and replace master cylinder
2. Overhaul master cylinder
3. Remove and replace wheel cylinders
4. Overhaul wheel cylinders
5. Remove and replace brake line
6. Fabricate new brake line
7. Remove and replace metering valve

8. Remove and replace proportioning valve
9. Bleed system
10. Activate warning system

Servicing Wheels and Tires (C-2)

1. Check tire pressure
2. Determine proper pressure
3. Rotate tires
4. "X" tires
5. Dynamic balance tires
6. Static balance tires
7. Remove and replace tire from the wheel
8. Repair tubeless tire
9. Repair tube
10. Analyze tire wear problems
11. Dynamometer test for smoothness

Repairing Front and Rear Suspension (L-1-2)(M-2)

1. Lubricate steering and suspension
2. Test components for wear
3. Remove and replace idler arm
4. Remove and replace drag link
5. Remove and replace Pitman arm
6. Remove and replace steering wheel
7. Remove and replace gear box
8. Remove and replace steering column
9. Remove and replace power steering pump
10. Remove and replace shocks
11. Remove and replace front springs

12. Remove and replace rear springs
13. Remove and replace torsion bars
14. Remove and replace control arms
15. Remove and replace strut rods
16. Remove and replace ball joints
17. Remove and replace king pins
18. Remove and replace steering knuckle

Repairing Transmissions (M-1-2)

1. Remove transmission
2. Dismantle transmission
3. Replace bearings
4. Replace counter shaft
5. Replace main shaft
6. Replace input shaft
7. Replace speedometer
8. Replace tail shaft
9. Check for gear change
10. Replace linkage

Repairing Rear Axle and Drive Lines (M-1-2)

1. Remove and replace propshaft
2. Remove and replace universal joints
3. Remove and replace rear axles
4. Remove and replace axle bearings and seals
5. Remove and replace clutch assembly

Close shop for Summer

1. Clean shop
2. Clean equipment
3. Take inventory

COURSE OUTLINE FOR SENIOR AUTOMOTIVE

Orientation

1. Safety
2. Shop rules
3. Tool room
4. Locker area
5. Customer cars
6. Shop procedure
7. Shop equipment
8. Outside parking

Service Desk (A-1-2-3-4)

1. Maintain good customer relations
2. Write service orders
3. Schedule vehicles
4. Order parts
5. Monitor shop work
6. Inspect mechanic's work
7. Prepare vehicle defect report

Diagnosis (F-1)(G-1)(H-1)(I-1)(K-1)

1. Verify customer complaints
2. Analyze engine performance
3. Make compression tests
4. Analyze valve train problems
5. Determine starting malfunctions
6. Trouble shoot alternator
7. Inspect secondary circuit

8. Inspect primary circuit
9. Diagnose tire wear
10. Inspect shock absorbers
11. Make safety checks
12. Make carburetor inspections
13. Make fuel systems checks

Servicing Front End Assemblies (L-1-2)

1. Make vehicle safety check
2. Diagnose steering malfunctions
3. Remove and replace shock absorbers
4. Remove and replace tie rods
5. Remove and replace drag link
6. Remove and replace idler arms
7. Remove and replace springs
8. Remove and replace control arms
9. Remove and replace ball joints
10. Check and adjust caster, various types
11. Check and adjust camber, various types
12. Check and adjust toe-in
13. Check toe-out-on-turns
14. Remove and replace power steering pumps
15. Remove and replace steering gears

Tune-up and Electrical Service (H1-2-3)(E-1-2)

1. Diagnose failure to crank
2. Make battery tests
3. Make voltmeter and draw tests
4. Make hydrometer tests

5. Diagnose starter circuit
6. Make starter repairs
7. Diagnose failure to start
8. Make primary ignition checks
9. Make secondary ignition checks
10. Make fuel system checks
11. Use voltmeter
12. Use dwell meter
13. Use oscilloscope
14. Use vacuum-pressure guage
15. Employ various tune-up methods
16. Make compression tests
17. Use distributor strobe
18. Make distributor checks
19. Make carburetor adjustments
20. Overhaul carburetor
21. Test fuel pumps
22. Check D.C. charging systems
23. Check A.C. charging systems
24. Test emission systems
25. Test manifold heat valves

Major Engine and Drive Line Service (F-1-2-3-4)(M-2)

1. Remove engine
2. Remove accessories
3. Remove cylinder head
4. Disassemble cylinder
5. Grind valves

6. Grind seats
7. Test valve springs
8. Assemble cylinder head
9. Disassemble short block
10. Recondition cylinder
11. Inspect piston and rod
12. Inspect crankshaft
13. Inspect valve lifters
14. Inspect camshaft
15. Install camshaft
16. Install crankshaft
17. Time valves
18. Assemble engine
19. Install engine
20. Start new engine
21. Make final adjustments
22. Remove standard transmission
23. Disassemble transmission
24. Overhaul transmission
25. Assemble transmission
26. Remove clutch
27. Inspect fly wheel
28. Install clutch
29. Remove axle shafts and seals
30. Remove differential
31. Overhaul differential
32. Diagnose automatic transmission

33. Adjust automatic transmission externally
34. Adjust automatic transmission internally
35. Replace auto transmission filters
36. Remove and replace auto transmission neutral safety switches and modulators

Lubrication and Maintenance of Vehicle Service (C-1-2)

1. Lubricate chassis
2. Change oil in transmission
3. Change filters in engine and transmission
4. Pack wheel bearings
5. Replace wheel bearings and seals
6. Rotate tires
7. Install tires
8. Balance tires
9. Make tire repairs
10. Replace light bulbs
11. Aim headlights
12. Replace flasher unit
13. Replace stop light switches
14. Replace coolant hoses
15. Service accessory drive belts
16. Replace or service water pump
17. Service wiper blades and arms
18. Install antifreeze
19. Replace thermostat
20. Replace heater core and hoses
21. Replace shock absorbers
22. Repair drive shaft

23. Service battery and cables
24. Repair or replace exhaust system
25. Use oxygen-acetylene torch

Brake Service (I-1-2-3)(J-1-2)

1. Remove and replace brake drums
2. Turn brake drums and lathe
3. Remove and replace brake shoes
4. Clean backing plates and hardware
5. Remove and replace wheel cylinders
6. Rebuild wheel cylinders
7. Remove and replace brake lines, rigid
8. Make tubing flares
9. Remove and replace hoses, flexible
10. Adjust brakes
11. Service parking brake cable
12. Remove and replace calipers
13. Remove and replace rotors
14. Resurface calipers
15. Rebuild calipers
16. Remove and replace master cylinder
17. Rebuild master cylinder
18. Remove and replace stop light switch
19. Remove and replace power brake unit
20. Overhaul power unit
21. Test proportioning valve

Diagnosis and Service of Air Conditioning (P-1-2)

1. Handle refrigerant
2. Use manifold guage set
3. Make operational tests
4. Make leak tests
5. Discharge the system
6. Charge the system
7. Remove and replace the compressor

Close Shop for Summer

1. Clean shop floor and walls
2. Clean and paint shop equipment
3. Paint stall floor lines

AUTOMOTIVE MECHANICS
COURSE CONTENT

JUNIOR CLASS

The beginning of the junior class automotive mechanics instructions schedule appears on the opposite page. The laboratory component is arranged in instructional groups that include: the learning module/s along with the appropriate management, instructional and evaluation strategies. Where the rotation of students througn specific learning activities is required, a rotation schedule appears at the end of the respective instructional group/s.

It can be noted that each learning module is followed by a letter and number in parentheses. This letter and number code denotes the corresponding duty and task statement as they appear in the automotive mechanics occupational analysis which provided a basis for much of the instructional content.

The related technology component is sequenced by instructional days over the entire two-year duration of the program. To the extent possible, related instruction content correlates with the laboratory activities but will vary as the schedule and nature of specific content found in the related technology column was drawn from the automotive mechanics occupational analysis.

Instructional Grouping #1

Time Allotment 9 Hours - Days 1-3 plus 4 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A ORIENTATION		
Objective:		
The student will become familiar with the shop surroundings, and be able to function according to the rules and regulations set forth by the instructor.		
Orientation:		
1. Safety regulations	1	Classroom Procedure - Textbooks - Lockers
2. Shop tour		
3. Locker assignments		
4. Tool distribution and registration		
5. Personnel system	2	Personal Information - Fees - Grading System
6. Cleaning procedure		
7. Progress chart		
8. Daily procedure		
9. Engine assignments	3	Introduction to Auto Mechanics
10. Use of fire extinguishers		
11. Use of lifts		VICA Club Organization
12. Use of jacks		
13. Electrical outlets		
14. Power switches		

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
15. Exhaust system 16. Demonstration (engine disassembly) Management Strategy: The instructor will conduct a tour of the shop. Instructional Strategy: The instructor will give total group demonstrations as necessary. Evaluation Strategy: Verbal responses and continued observation throughout the school year will be the basis of evaluation.		

Instructional Grouping #2

Time Allotment 15 Hours - Days 4-8 plus 7 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A ENGINE DISASSEMBLY (F-2)		
Objective: The student will disassemble an engine, with no damage to the parts, according to the exact procedure prescribed by the instructor. Upon completion of this duty, the student will have acquired a working knowledge of the tools necessary to complete this task group.		
Engine Disassembly:		
1. Drain oil	4	Intake and Compression Strokes
2. Remove filter		
3. Remove rocker covers		Basic Geometry - Circles and Degrees
4. Remove carburetor		
5. Remove intake manifold		
6. Remove rocker arms or rocker shaft	5	Power and Exhaust Strokes
7. Remove pushrods		
8. Remove valve lifters		
9. Remove cylinder heads		
10. Remove fan and shroud	6	The Engine Block - Design and Reconditioning
11. Remove radiator		
12. Remove water pump		

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
13. Remove harmonic balancer		
14. Remove timing cover		
15. Remove timing chain and gear		
16. Remove crankshaft sprocket	7	Cylinder Head Function and Types
17. Remove distributor		
18. Remove camshaft		
19. Remove engine from stand		
20. Remove oil pan		
21. Remove oil pump		
22. Remove cylinder ridge	8	Piston - Function and Quiz
23. Remove rod caps		
24. Remove pistons		
25. Remove piston rings		
26. Remove main bearing caps		
27. Remove crankshaft		

Management Strategy:

Two students will be assigned to each of the ten engines in the Junior engine overhaul area of the shop. These engines are in running condition at the start of the project and have to be in that condition at the finish.

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Instructional Strategy: The instructor will demonstrate each of these tasks to the total group, over a period of four days on a separate engine which is exactly the same as the engines which the students are working on. Evaluation Strategy: The students will identify each part of the engine to the instructor, on an individual basis. The condition of these parts, and any breakage, will be determined at this time.		

Instructional Grouping #3

Time Allotment 30 Hours - Days 9-18 plus 15 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A ENGINE CLEANING (F-3)		
Objective: The student will clean all of his assigned engine parts, to industry accepted standards, and acquire a working knowledge of the importance of cleanliness during engine overhaul.		
Engine Cleaning:		
1. Clean rocker covers	9	Connecting Rods - Function and Reconditioning
2. Clean exterior of carburetor		
3. Clean intake manifold	10	Crankshafts - Function and Reconditioning
4. Clean and polish rocker arms or rocker shaft		
5. Clean pushrods	11	Flywheels - Purpose and Design
6. Clean lifters		
7. Clean cylinder heads		
8. Clean water pump	12	Piston Types and Design - Quiz
9. Clean harmonic balancer		
10. Clean timing cover		
11. Clean timing chain	13	Piston Oil Rings, Types and Replacement
12. Clean timing gear		
13. Clean crankshaft sprocket		

COURSE CONTENT

LABORATORY	RELATED TECHNOLOGY	
14. Clean distributor	14	Piston Compression Rings - Types and Replacement
15. Clean camshaft		
16. Clean oil pan	15	Cylinder Bore and Stroke
17. Clean oil pump		Computation of Displacement
18. Clean pistons	16	Cylinder Design and Repair
19. Clean ring grooves		
20. Clean connecting rods	17	Insert Bearing Design - Material and Replacement
21. Clean crankshaft		
22. Clean block	18	Insert Bearing Malfunctions - Quiz

Management Strategy:

When the student has completed one part of his engine, he may continue only with the instructor's approval. Each student will be responsible for the parts from his own engine.

Instructional Strategy:

The instructor will demonstrate the various cleaning procedures to the total group.

Evaluation Strategy:

The instructor will inspect each part of the student's engine as he finishes it. He will not be allowed to continue to the next part until the instructor approves the part he has just completed.

Instructional Grouping #4

Time Allotment 15 Hours - Days 19-23 plus 7 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A ENGINE ANALYSIS (F-4)		
Objective:		
The student will be able to measure all of the parts in his engine, evaluate their condition, and list the results, within trade accepted tolerances.		
Engine Analysis:		
1. Measure bore	19	Reading Micrometers
2. Measure taper		
3. Measure compression ring gap		
4. Measure oil ring gap		
5. Measure compression ring clearance	20	Inside and Outside Miscellaneous
6. Measure oil ring clearance		
7. Measure cylinder head warpage		
8. Measure valve guide clearance		
9. Measure valve stem wear	21	Dial Indicators-VICA
10. Measure valve head clearance		
11. Measure camshaft lift		
12. Measure camshaft end play		

COURSE CONTENT

LABORATORY		RELATED TECHNOLOGY
13. Measure crankshaft end play	22	Engine Measurements
14. Measure crankshaft main journals		
15. Measure crankshaft rod journals		
16. Measure wrist pin wear		
17. Measure piston heads		
18. Measure piston skirts	23	Engine Component Evaluation and Quiz
19. Measure bearing clearances		
Management Strategy:		
The students will take all measurements on their own engine parts, during the allotted time.		
Instructional Strategy:		
The instructor will demonstrate each of these measurements to the total group on the demonstration engine.		
Evaluation Strategy:		
The instructor will require proof of accuracy on each group of parts before the student may continue to the next group. This will be accomplished by spot checking each group of parts. The student must complete the worksheet.		

Instructional Grouping #5

Time Allotment 30 Hours - Days 24-33 plus 15 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A ENGINE BLOCK ASSEMBLIES (F-3) Objective: The student will be able to recondition an entire engine to trade accepted standards, during the allotted time, using all of the necessary equipment to perform this duty. Engine Block Assemblies:		
1. Boil engine block	24	Camshafts, Design and Function
2. Hone cylinders		Computing Lift and Duration
3. Insert camshaft		
4. Fit piston pins	25	Camshaft Applications
5. Recondition pistons		
6. Recondition rods	26	Valves
7. Recondition crankshaft		
8. Fit insert bearings		
9. Fit piston rings	27	Valve Timing
10. Install pistons		
11. Torque crankshaft to specifications		
12. Torque rods to specifications	28	Valve and Ignition Timing - Quiz
13. Insert rear main bearing seal		

COURSE CONTENT

LABORATORY		RELATED TECHNOLOGY
14. Install oil pump		
15. Install oil pan	29	Valve Lifters
16. Install camshaft		
17. Install timing gears and chain		
18. Install front crankshaft seal	30	Push Rods - Function, Design and Reconditioning
19. Install timing cover		
20. Install lifters		
21. Grind valves	31	Rocker Arm Assemblies and Reconditioning
22. Insert valves		
23. Mount cylinder heads		
24. Install pushrods		
25. Install rockershaft assembly	32	Cylinder Head Applications
26. Mount intake manifold		
27. Install carburetor		
28. Mount rocker covers	33	Intake Manifolds and Quiz
29. Install distributor		

Management Strategy:

The student will perform each operation on his own engine, in the Junior engine overhaul area.

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Instructional Strategy: The instructor will demonstrate each of these tasks on the demonstration engine. Evaluation Strategy: The instructor will require the student to have each task performed, personally analyzed and approved by the instructor before continuing to the next task.		

Instructional Grouping #6

Time Allotment 15 Hours - Days 34-38 plus 7 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A ENGINE STARTING (H-2) Objective: The student will be able to complete his engine and start it. The engine must run according to trade accepted standards. Upon completion of this Learning Module, the student will achieve the satisfaction of seeing his engine run. Engine Starting:		
1. Install oil	34	Exhaust Manifolds
2. Install coolant		
3. Install transmission fluid	35	Valve Grinding - Purpose and Function
4. Hook up fuel system		
5. Install plug wires	36	Valve Grinding Procedure
6. Install spark plugs		
7. Hook up ignition switch	37	Compression - Tests and Applications
8. Wire primary circuit		Unit Force - Pounds Per Square Inch
9. Hook up battery		
10. Hook up starting circuit		
11. Hook up exhaust system	38	Engine Rebuilding As A Career - Quiz
12. Prime carburetor		
13. Start engine		

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Management Strategy: The student will perform each task on his own engine. When all tasks are completed, the student will not attempt to start his engine without the supervision of the instructor. Instructional Strategy: The instructor will demonstrate each task on the demonstration engine. Evaluation Strategy: The student will be evaluated on the basis of how well his engine runs. The student will be required to perform a series of tests on his engine at a later date.		

Instructional Grouping #7

Time Allotment 30 Hours - Days 39-48 plus 15 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A ENGINE REMOVAL AND REPLACEMENT (F-2)		
LEARNING MODULE B IGNITION SYSTEM ANALYSIS (F-1)		
Objective: Engine removal and replacement The student will be able to remove and replace an engine in the allotted time, and be required to have the automobile roadworthy according to trade accepted standards. Upon completion of the duty, the student will have experienced the tasks involved in removing and replacing an engine for major repairs.		
Objective: Ignition system analysis The student will be able to perform the routine ignition system tests and measurements, while acquiring skill and accuracy in using the test equipment involved. Upon completion of these tasks, the student will have acquired experience in the importance of the accuracy involved with ignition systems.		
Engine Removal and Replacement:		
1. Remove drive shaft	39	Review of Engine Overhaul
2. Disconnect speedometer		

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
3. Disconnect transmission linkage		
4. Disconnect clutch linkage		
5. Remove starter		
6. Remove transmission	40	Engine Overhaul Terminology
7. Remove exhaust system		
8. Drain cooling system		
9. Disconnect heater hoses		
10. Disconnect vacuum lines		
11. Disconnect carburetor linkage	41	Review Functions of Engine Components
12. Remove power steering pump		
13. Remove alternator		
14. Remove air conditioning compressor	42	Examination-VICA Meeting
15. Remove all electrical leads		
16. Remove motor mount through bolts		
17. Remove engine		
18. Clean engine	43	Introduction to Ignition Systems
19. Reverse tasks 1 - 17		Volts, Amps, Ohms
20. Start engine		
21. Test systems	44	Use of Dwell Meter

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Ignition System Analysis:		
1. Take compression test		
2. Take leak down test		
3. Inspect spark plugs		
	45	Use of a Tachometer
4. Set timing with a vacuum gauge		
5. Set timing with a timing light	46	Use of a Timing Light
6. Set dwell with a feeler gauge		
7. Set dwell with a dwell meter	47	Reading Manufacturers' Specifications
8. Adjust carburetor with a tachometer		
9. Determine firing order	48	Use of Vacuum Gauges and Feeler Gauges
10. Remove and replace distributor		

Management Strategy:

One-half of the students will work in teams of two, removing and replacing the engines on five live vehicles. Each team will be assigned to one vehicle.

The other half of the group will perform the Ignition Analysis tasks on the engines in the Live Engine area. They will work individually on the ten engines in running condition. After each day's work,

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
the student will be assigned to a new engine. After the first week, the two groups will rotate and continue work for another week. Instructional Strategy: The instructor will demonstrate to one-half of the group, each task which they are required to perform. Evaluation Strategy: The Engine Removal and Replacement duty will be evaluated on the basis of how well the engine runs and the automobile's roadworthiness. The Ignition Analysis group will be required to show the instructor each setting or adjustment they have made on their engines each day, and complete the worksheets provided by the instructor.		

ROTATION SCHEDULE

Instructional Grouping #7

ENGINE REMOVAL AND IGNITION ANALYSIS

	INSTRUCTOR	WEEK 1	WEEK 2
Module "A" Five "Live" Vehicles	Daily short demonstrations and coaching on Engine Repair & Replacement and	Teams 1 - 5 Remove, clean and replace engine	Teams 6 - 10
Module "B" Ten "Live" Lab Engines	Engine Ignition Analysis	Teams 6 - 10 (Operating as individuals) Ignition Analysis	Teams 1 - 5

This rotation chart is for Instructional Group #7 only. In Groups 1 - 6, all students are performing work in the same module.

Instructional Grouping #8

Time Allotment 45 Hours - Days 49-63 plus 22 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A IGNITION TUNE-UP AND TESTING (H-2) Objective: Given an engine with ignition system problems, the student will be able to locate and repair these malfunctions, with the speed and accuracy which is acceptable to trade standards, for an advanced learner. Ignition Tune-up and Testing:		
1. Remove plug wires	49	Components of the Primary Circuit
2. Determine plug size		
3. Inspect new plugs	50	Components of the Secondary Circuit
4. Service used plugs		
5. Gap plugs	51	Electrical Theory - Electrons - Current Flow
6. Replace plug wires		
7. Remove and replace coil	52	Electrical Theory - Magnetism
8. Test primary windings		
9. Test secondary windings	53	Electrical Terminology
10. Determine distributor advance curve	54	Ohms Law
11. Remove and replace points		
12. Check point resistance	55	Operation of the Primary Circuit
13. Check point tension		

COURSE CONTENT

	LABORATORY		RELATED TECHNOLOGY
14.	Check condenser	56	Operation of the Secondary Circuit
15.	Check primary voltage	57	Operation of a Coil
16.	Disassemble distributor		
17.	Assemble distributor to specifications	58	Operation of Contact Points and Condensers
18.	Time engine	59	Operation of Resistors
19.	Scope test ignition	60	Distributor Cap and Rotor
20.	Set engine to standards by use of an infrared	61	Spark Plugs
		62	Spark Plug Wires
		63	Examination

Management Strategy:

The students will be rotated daily and be required to perform five complete tune-ups on the engines in the Engine Overhaul area which have been "bugged" by the instructor. They will also be required to complete five tune-ups on the vehicles which are school-owned and have also had built in problems. A worksheet will be provided for each tune-up.

At the end of the module, each student will have completed ten tune-ups and tested them on the equipment on which they have received instruction.

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Instructional Strategy: The instructor will spend the first two days of the ignition testing tune-up module giving total group demonstrations for engine tune-up. The first week of this module, the instructor will instruct four students each day on the use of the distributor strobe machine. The same method will be used the second and third week for the Ignition Scope equipment and Infrared Analyzer. Evaluation Strategy: The instructor will analyze the student's worksheet each day, and spot check his tune-up. At the end of the three-week module, each student will be tested by doing another physical tune-up in the Engine Overhaul area, with no assistance from the instructor or classmates.		

ROTATION SCHEDULE

Instructional Grouping #8

IGNITION TUNE-UP AND TESTING

	INSTRUCTOR	WEEK 1	WEEK 2	WEEK 3
MODULE "A" Five Live Vehicles	First two days total group demonstration	Students 1-5 work on live vehicles. Rotate vehicle each day.	Students 6-14 work on live vehicles. Rotate vehicle each day.	Students 15-20 work on live vehicles. Rotate vehicle each day.
MODULE "B" * Eleven Live Engines		Students 6-14 work on live engines. Rotate engines each day. Also students 15-20	Students 1-5 work on live engines. Rotate engines each day. Also students 15-20	Students 1-5 work on live engines. Rotate engines each day. Also students 6-14
MODULE "C" Infrared Distributor Strobe Scope	Demonstration 4 students each day for weeks 3, 1, and 2			

*Instructor selects four students per day from Module B and works with them on Module C.

Instructional Grouping #9

Time Allotment 15 Hours - Days 64-68 plus 7 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A CRANKING MOTORS (P-1)		
Objective:		
Given a cranking system of any style, the student will be able to diagnose malfunctions in the cranking circuit and perform the necessary repairs in order to make the system function.		
Cranking Motors:		
1. Perform cranking system voltage and amperage tests	64	Cranking System and Function
2. Remove and replace cranking motors	65	Cranking System Circuitry
3. Overhaul a General Motors starter	66	Cranking Motor Components
4. Overhaul a Chrysler Corp. starter	67	Cranking Motor Operation and Repairs
5. Overhaul a Ford Motor starter		
6. Test starting components for malfunctions.	68	Types of Cranking Motors - Quiz
Management Strategy:		
The last three days will be spent by the students overhauling at least three starters of various makes, the last one of which will be mounted on an engine or		

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
vehicle, and must function at the completion of the duty. Instructional Strategy: The instructor will spend the first two days of this module giving total group demonstrations on starting system testing and starter motor overhaul. Evaluation Strategy: The instructor will base his evaluation on the student's ability to overhaul a starting motor, mount it on an engine, and have it function properly.		

Instructional Grouping #10

Time Allotment 75 Hours - Days 69-93 plus 37 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A REPAIRING GENERATORS (P-2)		
LEARNING MODULE B REPAIRING A/C UNITS (P-1)		
LEARNING MODULE C REPAIRING REGULATORS (P-2)		
LEARNING MODULE D TESTING CIRCUITRY (P-1)		
Objective: Generators Given a generator of any make, the student will be able to diagnose malfunctions in the unit, and perform the necessary repairs to make it function.		
Objective: Alternators Given an alternator of any make, the student will be able to diagnose any malfunctions in the unit, and perform the necessary repairs to make it function.		
Objective: Regulators Given a regulator of any make, the student will be able to diagnose any malfunctions and perform the necessary repairs to make it function.		
Objective: Circuitry Given an electrical circuit, the student will be able to diagnose the problems in the circuitry and perform the necessary repairs to make the circuit function.		

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Generators:		
1. Measure generator voltage output		
2. Measure amperage output		
3. Measure resistance	69	Charging System Function
4. Measure capacity	70	Charging System Operation
5. Perform growler test	71	Battery Function Chemical Symbols
6. Perform resistance test		
7. Perform open circuit test	72	Battery Service and Construction
8. Perform generator output test	73	Battery Testing--(See Appendices for a Lesson Plan)
9. Remove and replace generator		
10. Replace generator brushes	74	Generator Function
11. Replace generator armature	75	Generator Construction
12. Replace generator field coil	76	D. C. Operation Theory
13. Replace generator end plate bearings	77	Generator Testing and Overhaul - Quiz
14. Service generator		

COURSE CONTENT

LABORATORY		RELATED TECHNOLOGY
Alternators:		
1. Remove and replace alternator	78	Regulator Function
2. Measure alternator voltage output	79	Regulator Construction
3. Measure alternator amperage output		
4. Measure alternator resistance	80	Regulator Operation
5. Measure alternator capacity	81	A.C. Regulators
6. Perform alternator resistance tests		
7. Perform alternator open circuit tests	82	Internal Regulators
8. Perform alternator output tests	83	Alternator Construction
9. Replace alternator brushes		
10. Replace alternator rotor	84	Alternator Operation
11. Replace alternator windings		
12. Test and replace alternator diodes	85	A.C. Rectifying
13. Replace alternator bearings		
14. Service alternator	86	Alternator Service and Overhaul

COURSE CONTENT

LABORATORY		RELATED TECHNOLOGY
Regulators:		
1. Remove and replace regulator	87	Examination
2. Test current regulator		
3. Test voltage regulator	88	Introduction to Circuitry
4. Test cutout regulator		
5. Adjust current regulator	89	Types of Circuits
6. Adjust voltage regulator		
7. Adjust cutout regulator		
8. Test internal regulators	90	Circuitry Malfunctions
Circuitry:		
1. Test for draw on battery	91	Circuitry Color Coding
2. Test for voltage drop		
3. Test for amperage draw	92	Circuitry Testing
4. Test for shorted circuit		
5. Locate draw on battery		
6. Locate short circuit	93	Circuitry Testing Continued - Quiz
Management Strategy:		
Sufficient alternators, regulators, generators, and vehicles are available and will be used as follows:		
1. Second week, six students perform generator tests and overhaul.		

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
2. Third week, the same six students perform alternator and regulator tests and overhaul.		
3. Fourth and fifth weeks, these students will locate malfunctions of circuitry in the school-owned vehicles.		
The instructor will provide the necessary malfunctions in the vehicles.		
There will be three groups of students who will rotate and perform each of these modules over the four-week period.		
Instructional Strategy:		
The instructor will spend the first five days of this module grouping, giving total group demonstrations on generator testing and overhaul, alternator testing and repair, and circuitry. (See Appendices for Lesson Plan)		
Evaluation Strategy:		
The students will be evaluated in each module by showing their ability to conduct the measurements required on provided worksheets, and by physically making their units function according to the manufacturers' standards.		

ROTATION SCHEDULE

Instructional Grouping #10

GENERATORS-REGULATORS-ALTERNATORS-CIRCUITRY

	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5
MODULE "A" Generator Tests and Overhaul	Total group demonstrations by instructor	Students 1 - 7	Students 8 - 14	Students 15 - 20	Students
MODULE "B" Alternator & Regulator Tests & Overhaul	Total group demonstrations by instructor	Students 8 - 14	Students 1 - 7	Students	Students 15 - 20
MODULE "C" Circuitry	Total group demonstrations by instructor	Students 15 - 20	Students 15 - 20	Students 1 - 7 Students 8 - 14	Students 1 - 7 Students 8 - 14

Instructional Grouping #11

Time Allotment 9 Hours - Days 94-96 plus 4 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY

LEARNING MODULE A
FUEL TANKS (E-1)

LEARNING MODULE B
FUEL PUMPS (E-1)

LEARNING MODULE C
AIR CLEANERS (E-2)

Objective: Fuel Tanks

Given a fuel tank, the student will be able to remove and replace this tank, conduct accurate fuel gauge tests, and have the tank and gauge function correctly at the finish of the duty.

Objective: Fuel Pumps

Given a fuel pump, the student will be able to remove it from the engine, test it for capacity, overhaul the pump, and replace it. The pump will function well enough upon completion to keep the engine running smoothly at any speed.

Objective: Air Cleaners

Given an air cleaner, the student will be able to service the unit and have all systems functioning upon completion of the task group.

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Fuel Tanks:		
1. Remove fuel		
2. Remove fuel Tank		
3. Remove fuel gauge		
4. Test fuel gauge		
5. Repair fuel gauge	94	Fuel - Composition, Measurement, Application
6. Replace fuel tank		
7. Test for leaks		
8. Test fuel gauge for accuracy		
Fuel Pumps:		
1. Vacuum test pump		
2. Pressure test pump		
3. Remove pump	95	Pre-ignition - Detonation - Diesling
4. Replace diaphram		
5. Replace pump		
Air Cleaners:		
1. Remove air cleaner		
2. Service heat doors		
3. Service linkage	96	Air Cleaner - Construction - Styles - Function - VICA Meeting
4. Test heat sensor		
5. Replace air cleaner		
6. Test for vacuum leaks		

COURSE CONTENT

LABORATORY	RELATED TECHNOLOGY	
	Instructional Day	
Management Strategy: The students will be divided into three groups and spend one day on each module. Each student will be required to complete each task for the three modules over the three-day period. Instructional Strategy: The instructor will give a demonstration to each group at the beginning of each of the three days. Evaluation Strategy: The fuel tank module will be evaluated on the basis of the student's ability to complete the task grouping and have the fuel gauge work correctly. The fuel pump module will be evaluated by a comparison of the student's vacuum and capacity measurements and the instructor's. The air filter module will be evaluated by the instructor inspecting the student's unit after servicing.		

ROTATION SCHEDULE

Instructional Grouping #11

FUEL TANKS - FUEL PUMPS - AIR CLEANERS

	INSTRUCTOR	DAY 1	DAY 2	DAY 3
MODULE "A" Fuel Tanks	Short demonstrations each day	Students 1 - 7	Students 16 - 20	Students 8 - 15
MODULE "B" Fuel Pumps		Students 8 - 15	Students 1 - 7	Students 16 - 20
MODULE "C" Air Cleaners		Students 16 - 20	Students 8 - 15	Students 1 - 7

Instructional Grouping #12

Time Allotment 30 Hours - Days 97-106 plus 15 hours
LAB RELATED

COURSE CONTENT

LABORATORY

LEARNING MODULE A
CARBURETORS (E-2)

Objective:

Given a carburetor of any size or make, the student will be able to overhaul the carburetor, identify all the major parts and circuits, and have it function on an engine according to the manufacturers' specifications.

Carburetors:

1. Remove carburetor
2. Dismantle carburetor
3. Clean carburetor
4. Overhaul carburetor
5. Adjust to specifications
6. Install carburetor
7. Adjust air-fuel ratio
8. Adjust engine idle

Management Strategy:

The students will be required to dismantle and reassemble a one-barrel, two-barrel, and four-barrel carburetor.

RELATED TECHNOLOGY

Instructional Day	
97	Storage Tanks
98	Fuel Lines - Construction, Malfunctions and Repairs
99	Fuel Gauges
100	Fuel Pumps VICA Meeting
101	Theory of Carburetors Air Flow Principles
102	Carburetor Circuits
103	Carburetor Circuits Continued
104	Carburetor Overhaul
105	Fuel Injection
106	Diesel Theory and Examination

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY

There are enough demonstration carburetors available for each student to work individually.

Upon completion of these three carburetors, the students will overhaul the carburetor on the engine in the Junior Engine Overhaul area, which is assigned to teams of two students.

The faster students will also overhaul a carburetor on one of the school-owned vehicles and dynamometer test it.

Instructional Strategy:

The instructor will spend the first day giving a total group demonstration.

Evaluation Strategy:

Each carburetor that the student dismantles must be inspected by the instructor before it can be reassembled. The student will be required to identify each circuit and each major part. The "live" carburetor work will be evaluated on the basis of how well it functions.

Instructional Grouping #13

Time Allotment 15 Hours - Days 107-111 plus 7 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A EMISSION CONTROLS (E-2) Objective: Given a group of emission controls, the student will be able to analyze their condition, repair malfunctions, and have the vehicle operate according to government emission control standards. Emission Controls:		
1. Remove exhaust pipe	107	Emission Control
2. Remove heat riser		
3. Remove exhaust manifold		
4. Replace gaskets		
5. Remove and replace tail pipe	108	Crankcase Emissions
6. Remove and replace muffler		
7. Remove and replace catalytic converter		
8. Service P.C.V. system	109	Fuel Evaporative Emissions
9. Test P.C.V. valve		
10. Remove and replace A.I.R. pump		
11. Check diverter valve	110	Exhaust Emissions
12. Check operation of check valve		

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
13. Remove and replace belts		
14. Replace evaporative filters		
15. Calibrate infrared equipment		
16. Analyze hydrocarbons	111	Engine Modifications
17. Analyze carbon monoxide		Quiz VICA Meeting
18. Adjust to specifications		

Management Strategy:

The class will be divided into two groups. One group will work in teams of two on five of the school owned vehicles for two and one-half days. During this time, each team must remove and replace one complete exhaust system, including the manifolds.

The other group will service the emission controls on their engines in the Junior Engine Overhaul area, and test these engines on the infrared equipment, and make the required adjustments.

At mid-week, the two groups will rotate and go to the opposite task group.

Instructional Strategy:

The instructor will give demonstrations to each group at the beginning of each day.

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Evaluation Strategy: The exhaust system module will be evaluated by the instructor on the basis of how quiet the exhaust system is, and how well it is installed. The emission module students will receive a worksheet which will take two days to finish. The results on these worksheets will be analyzed by the instructor.		

ROTATION SCHEDULE

Instructional Grouping #13

EMISSION CONTROLS

	INSTRUCTOR	FIRST HALF OF WEEK	SECOND HALF OF WEEK
MODULE "A" Exhaust work on live vehicles	Daily demonstrations at the start of class each day	Students 1 - 10	Students 11 - 20
MODULE "B" Emission control work on live engines		Students 11 - 20	Students 1 - 10

Instructional Grouping #14

Time Allotment 15 Hours - Days 112-116 plus 7 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY	RELATED TECHNOLOGY	
	Instructional Day	
LEARNING MODULE A SERVICING AND REPAIRING COOLING SYSTEMS (D-1-2)		
Objective: Given a cooling system on any make of car, the student will be able to service it, analyze its condition, and repair as necessary, so that the automobile will operate with no coolant loss or overheating.		
Servicing and Repairing Cooling Systems:		
1. Remove cap	112	Cooling System Fundamentals Calorimetry Temperature
2. Fill reservoir		
3. Pressure test		
4. Check temperature	113	Liquid Cooling - Purpose and Function
5. Analyze protection		
6. Service cooling system		
7. Replace radiator	114	Radiators - Fans - Belts and Pulleys
8. Replace water pump		
9. Replace expansion plug		
10. Replace thermostat	115	Thermostats - Hoses - Water Pumps - Expansion
11. Replace heater hoses		
12. Replace radiator hoses	116	Cooling System Service, Types of Coolant - Quiz VICA Meeting
13. Replace heater core		

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Management Strategy: Following the demonstrations, the students will split into two groups—one-half on the vehicles and one-half in the Junior Engine area. The students will work in teams of two, and rotate midweek. Instructional Strategy: The instructor will give total group demonstrations the first day of the module. Evaluation Strategy: The instructor will base his evaluation on the performance of the system at the completion of the Task Group. The main factors he will consider are leakage and the temperature at which the engine operates.		

ROTATION SCHEDULE

Instructional Grouping #14

COOLING SYSTEMS

	INSTRUCTOR	FIRST HALF OF WEEK	SECOND HALF OF WEEK
MODULE "A" Live engine cooling systems	Demonstrations to the total group, the first day of the modules	Students 1- 10	Students 11 - 20
MODULE "B" School owned vehicles cooling systems		Students 11 - 20	Students 1- 10

Instructional Grouping #15

Time Allotment 30 Hours - Days 117-126 plus 15 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A SERVICING AND REPAIRING BRAKING SYSTEMS (MECHANICAL) (I-1)(J-1) Objective: Given a set of brakes, the student will be able to recondition the system, and have them function according to trade accepted standards, within a time period acceptable for an advanced learner in the trade. Servicing and Repairing Braking Systems (Mechanical):		
1. Remove front drums	117	Brake Theory - Styles and Function
2. Remove rear drums		Coefficient of Friction
3. Repack front bearings	118	Brake Lining Material
4. Turn drums	119	Brake Drums - Material and Function
5. Grind drums		
	120	Brake Drum Turning
6. Resurface rotors		
7. Remove brake shoes	121	Brake Servicing
8. Test springs	122	Power Brakes
9. Service self-adjusters	123	Disc Brakes
10. Install new shoes	124	Air Brakes
11. Replace drums	125	Brake Service Specialization
12. Service parking brake	126	Examination
13. Adjust brakes		VICA Meeting

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Management Strategy: The students will work in teams of two. One-half of the group will perform the tasks on the five axles (2 wheels) in the Machine Shop area for one week, in order to gain speed and proficiency. The other half will perform the tasks on five of the school owned vehicles. At the end of one week, the two groups will rotate. Instructional Strategy: The instructor will give a total group demonstration the first day, and demonstrate the drum lathe to small groups (two students) during the course of the two weeks. Evaluation Strategy: The instructor will require the students to get his approval before installing the brake drum each time a wheel is completed. The brake work on the automobiles will by dynamometer tested for braking speed and even stopping.		

ROTATION SCHEDULE

Instructional Grouping #15

BRAKES

	INSTRUCTOR	WEEK 1	WEEK 2
MODULE "A" Axle work (five)	Total group demonstration the first day, and drum lathe demonstrations to groups of two throughout the modules	Students 1 - 10	Students 11 - 20
MODULE "B" Live vehicle work (five)		Students 11 - 20	Students 1 - 10

Instructional Grouping #16

Time Allotment 30 Hours - Days 127-136 plus 15 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A SERVICING AND REPAIRING BRAKING SYSTEMS (HYDRAULIC) (I-1)(J-1) Objective: Given an automobile, the student will be able to overhaul the entire hydraulic system, and have it function according to trade accepted standards, within a time period acceptable for an advanced learner in the trade. Servicing and Repairing Braking Systems (Hydraulic):		
1. Remove and replace master cylinder	127	Hydraulic Theory Pascal's Law
2. Overhaul master cylinder	128	Brake Fluid Circulation
3. Remove and replace wheel cylinders	129	Brake Fluid - Composition - Function
4. Overhaul wheel cylinders	130	Master Cylinders Area Computations
5. Remove and replace brake line	131	Proportioning Valves
6. Fabricate new brake line	132	Metering Valves
7. Remove and replace metering valve	133	Warning Lights
8. Remove and replace proportioning valve	134	Wheel Cylinders-VICA
9. Bleed system	135	Hydraulic Overhaul
10. Activate warning system	136	Brake Safety - Trouble Shooting and Testing

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Management Strategy: The students will work in teams of four (one student on each wheel), on five of the school vehicles. Each group will work on a different vehicle each day. During the course of each day, the students will recondition both a front and rear wheel. In addition, each student will be required to overhaul one master cylinder off the car. Instructional Strategy: The instructor will give a total group demonstration the first day. Evaluation Strategy: The instructor will inspect each wheel before the brake drum is installed. The student will be evaluated on the basis of speed, accuracy, and cleanliness. Each vehicle will be dynamometer tested for braking proficiency at the end of each session.		

Instructional Grouping #17

Time Allotment 15 Hours - Days 137-141 plus 7 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A WHEELS AND TIRES (C-2)		
Objective: Given a tire and wheel, the student will be able to diagnose any malfunctions, perform those tasks to eliminate those malfunctions, and have the tire perform smoothly and quietly on the vehicle.		
Wheels and Tires:		
1. Check tire pressure	137	Tire Industry - Growth - Importance - Effect
2. Determine proper pressure		
3. Rotate tires	138	Tire Construction
4. "X" tires		
5. Dynamic balance tires	139	Tire Wear Patterns
6. Static balance tires		
7. Remove and replace tire from the wheel	140	Wheels - Styles - Functions - Construction
8. Repair tubeless tire		
9. Repair tube	141	Tire Balance - VICA
10. Analyze tire wear problems		
11. Dynamometer test for smoothness		

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Management Strategy: The students will work individually on twenty-four tires, off six of the school vehicles. Five students will work on one of the two tire machines, five on one of the two balancers, five repairing leaks provided by the instructor, and five on the dynamometer, testing for smoothness and accuracy. The tasks performed will be rotated each day. Instructional Strategy: The instructor will give small group demonstrations to each group daily. Evaluation Strategy: The instructor will observe each student perform on the tire machine and wheel balancer. Final evaluation will be based on the outcome of each tire on the dynamometer.		

ROTATION SCHEDULE

Instructional Grouping #17

WHEELS AND TIRES

	INSTRUCTOR	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
MODULE "A" Tire Machines	Short demonstrations to each group daily	Students 1 - 5	Students 16 - 20	Students 6 - 10	Students 11 - 15	Review and practice based upon individual student needs
MODULE "B" Balancers		Students 6 - 10	Students 11 - 15	Students 16 - 20	Students 1 - 5	Review and practice based upon individual student needs
MODULE "C" Leaks		Students 11 - 15	Students 6 - 10	Students 1 - 5	Students 16 - 20	Review and practice based upon individual student needs
MODULE "D" Dynamometer		Students 16 - 20	Students 1 - 5	Students 11 - 15	Students 6 - 10	Review and practice based upon individual student needs

Instructional Grouping #18

Time Allotment 60 Hours - Days 142-161 plus 30 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A FRONT SUSPENSION (L-1-2) (M-2) LEARNING MODULE B REAR SUSPENSION Objective: Given a vehicle, the student will be able to analyze malfunctions in the front or rear suspension, make the necessary repairs, and have the automobile perform smoothly, safely and quietly. Front Suspension:		
1. Lubricate steering and suspension	142	Suspension Theory and Function
2. Test components for wear	143	Steering Operation
3. Remove and replace idler arm	144	Steering Construction
	145	Standard Steering Components
4. Remove and replace drag link	146	Power Steering Operation
5. Remove and replace Pitman arm	147	Steering Columns
	148	Front Suspension Components
6. Remove and replace steering wheel	149	Rear Suspension Components
7. Remove and replace gear box	150	Types of Front Suspension
	151	Types of Rear Suspension
8. Remove and replace steering column	152	Shock Absorbers
9. Remove and replace power steering pump	153	Springs - VICA

COURSE CONTENT

LABORATORY	RELATED TECHNOLOGY	
10. Remove and replace shocks	154	Control Arms
11. Remove and replace front springs	155	Ball Joints
12. Remove and replace rear springs	156	Front Suspension Overhaul
13. Remove and replace torsion bars	157	Rear Suspension Overhaul
14. Remove and replace control arms	158	Steering Linkage Overhaul
15. Remove and replace strut rods	159	Front End Geometry
16. Remove and replace ball joints	160	Front End Geometry Continued
17. Remove and replace king pins	161	Examination
18. Remove and replace steering knuckle		

Management Strategy:

The students will be assigned to a different task or task group each day, and be required to complete all of the tasks by the end of the module.

Five school owned vehicles will be used for this purpose, the students working in teams of two. The tasks assigned to each car will be such that the students do not interfere with one another.

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
The faster students who complete their daily task or task group early each day will be introduced to front end alignment on a separate vehicle by the instructor. Instructional Strategy: Because of the size of this task group, the instructor will give one all-day total group demonstration each week. Evaluation Strategy: The instructor will indicate each student's progress each day on the progress chart. Before a student receives credit for a task, the work must be inspected by the instructor.		

ROTATION SCHEDULE

Instructional Grouping #18

FRONT SUSPENSION - REAR SUSPENSION

	INSTRUCTOR	WEEK 1	WEEK 2	WEEK 3	WEEK 4
MODULE "A" Task Group 1 - 4	One total group demonstration the first day of each week	Students 1 - 5	Students 6 - 10	Students 11 - 15	Students 16 - 20
MODULE "B" Task Group 5 - 8	Front end alignment demonstrations to small groups each day throughout module	Students 6 - 10	Students 1 - 5	Students 16 - 20	Students 11 - 15
MODULE "C" Task Group 9 - 12	Front end alignment demonstrations to small groups each day throughout module	Students 11 - 15	Students 16 - 20	Students 1 - 5	Students 6 - 10
MODULE "D" Task Group 13 - 16		Students 16 - 20	Students 11 - 15	Students 6 - 10	Students 1 - 5

Instructional Grouping #19

Time Allotment 36 Hours - Days 162-173 plus 18 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A REPAIRING TRANSMISSIONS (N-1-2) Objective: Given a standard transmission of any kind, the student will be able to dismantle and reassemble it, and have it function in all gears smoothly and quietly. Repairing Transmissions:		
1. Remove transmission	162	Gear Design Principles of Levers
2. Dismantle transmission		
3. Replace bearings	163	Gear Reduction Ratio Computations
4. Replace counter shaft	164	Syncromesh Design
5. Replace main shaft	165	Three-Speed Transmissions
6. Replace input shaft	166	Four-Speed Transmissions
7. Replace speedometer	167	Counter Shaft Design and Function
8. Replace tail shaft	168	Main Shaft Design and Function
9. Check for gear change	169	Transmission Shifting Mechanisms
10. Replace linkage	170	Automatic Transmission Theory
	171	Automatic Transmission Theory Continued - Quiz
	172	Overdrives
	173	Examination - VICA

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Management Strategy: There will be ten three-speed standard transmissions available for this task group. Each team of two students will be required to overhaul three transmissions during the three-week period. Instructional Strategy: The instructor will give total group demonstrations the first two days. The faster teams will spend any time remaining on four-speed transmissions. Evaluation Strategy: The students will be required to identify each part of the transmission when it is dismantled. The instructor will inspect each completed transmission for smoothness of gear change.		

Instructional Grouping #20

Time Allotment 15 Hours - Days 174-178 plus 7 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A DRIVE LINES (M-1-2)		
Objective: Given an automobile, the student will be able to identify problems in the system, and repair them to trade accepted standards.		
Drive Lines:		
1. Remove and replace propshaft	174	Drive Line Theory
2. Remove and replace universal joints	175	Types of Propshafts
3. Remove and replace rear axles	176	Types of Universal Joints - VICA
4. Remove and replace axle bearings and seals	177	Differential Theory
5. Remove and replace clutch assembly	178	Differential Design
Management Strategy: The students will be assigned to one of five vehicles and work in groups of two on assigned tasks. The task assigned to each group will be rotated each day.		

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Instructional Strategy: The instructor will give total group demonstrations the first two days. Evaluation Strategy: The instructor will personally supervise each team's work. Final evaluation will be based on how well the task group is completed.		

ROTATION SCHEDULE

Instructional Grouping #20

DRIVE LINES

	INSTRUCTOR	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
MODULE "A" Task 1	Demonstrations given the first day of each module	Students 1 - 4	Students 5 - 9	Students 10 - 14	Students 15 - 18	Students 19 - 20
MODULE "B" Task 2		Students 5 - 9	Students 10 - 14	Students 15 - 18	Students 19 - 20	Students 1 - 4
MODULE "C" Task 3		Students 10 - 14	Students 15 - 18	Students 19 - 20	Students 1 - 4	Students 5 - 9
MODULE "D" Task 4		Students 15 - 18	Students 19 - 20	Students 1 - 4	Students 5 - 9	Students 10 - 14
MODULE "E" Task 5		Students 19 - 20	Students 1 - 4	Students 5 - 9	Students 10 - 14	Students 15 - 18

Instructional Grouping #21

Time Allotment 6 Hours - Days 179-180 plus 3 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A CLOSE SHOP FOR SUMMER		
Close Shop for Summer:		
1. Clean shop		
2. Clean equipment	179	Final Examination
3. Inventory	180	Closing Duties - Guest Speaker - Senior Instructor

AUTO MECHANICS

COURSE CONTENT

Senior Class

Instructional Grouping #22

Time Allotment 9 Hours - Days 181-183 plus 4 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A ORIENTATION		
Objective: To familiarize the student with the overall functioning of a production shop with respect to safety, operation and management.		
Orientation:		
1. Safety 2. Shop rules 3. Tool room 4. Locker area	181	Class Procedure a. Introductions b. Course Objectives c. Course Outline d. Course Requirements e. Grading System
5. Customer cars 6. Shop procedure 7. Shop equipment a. Lifts b. Jacks c. Drum lathes	182	Opportunities in Automotive a. Entry Requirements b. Advancement c. Pay Rate - Flat Rate System Payroll Computations
d. Fire extinguishers e. Tune-up meters f. Tire changer g. Wheel balancer 8. Outside parking	183	Mechanics' Responsibilities a. To Customer b. To Himself c. To Auto Industry d. To Employer

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Management Strategy: Facility.--Complete tour of shop. Equipment.--All of the above named, plus one automobile for demonstration. One separate brake drum and rotor. Rotation.--None. Complete group instruction. Instructional Strategy: The instructor will conduct a group tour of the shop, assign lockers, work stations and institute student personnel system. Salient points of shop equipment will be reviewed. Evaluation Strategy: Verbal responses and student demonstration, at this time, with continued observation during the school year.		

Instructional Grouping #23

Time Allotment 60 Hours - Days 184-203 plus 30 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A SERVICE DESK (A-1-2-3-4)		
LEARNING MODULE B DIAGNOSIS (F-1)(G-1)(H-1)(I-1)(K-1)		
Objective:		
Given a customer and vehicle, the student will greet the customer, write the service order, verify the customer complaint, analyze the problem and route the vehicle to the proper service area to have the work performed by other students.		
Upon completion of the prescribed work, he will evaluate the vehicle for quality workmanship. He will complete the service order and send it to the school accounting office.		
Repairs and service orders will comply with industry standards and customer satisfaction.		
Service Desk:		
1. Maintain good customer relations	184	Customer Relations
2. Write service orders	185	Service Orders
3. Schedule vehicles	186	Shop Management and Cost Accounting
4. Order parts		Work Load Monitoring

COURSE CONTENT

LABORATORY	RELATED TECHNOLOGY	
5. Monitor shop work	187	Vehicle Inspection Reports
6. Inspect mechanic's work	188	Battery Observation and Tests
7. Prepare vehicle defect report	189	Starter Circuit History
	190	Relays and Solenoids
Diagnosis:	191	Relay Starter Circuitry
1. Verify customer complaints	192	Solenoid Circuitry
2. Analyze engine performance	193	Trouble Shooting Procedure
	194	Examination
3. Make compression tests	195	Engine Performance Analysis - Horse Power per Cubic Inch
4. Analyze valve train problems	196	Compression Faults
5. Determine starting malfunctions	197	Ignition Primary Problems
6. Trouble shoot alternator	198	Ignition Secondary Problems
7. Inspect secondary circuit	199	Spark Plug Analysis
8. Inspect primary circuit	200	Fuel System Problems
9. Diagnose tire wear	201	Carburetor Faults
10. Inspect shock absorbers	202	Review
11. Make safety checks	203	Examination
12. Make carburetor inspections		
13. Make fuel systems checks		

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Management Strategy: Two students will be assigned to this group for a total period of four weeks, not necessarily consecutively. One will act as Service Manager and the other will do vehicle checks and diagnostics. The Service Manager will join in diagnosing, both will do small repairs and quality inspections, as well as the necessary paper work. Instructional Strategy: The instructor will work closely with this team—coaching, demonstrating and teaching. They will continually assume more of the workload to free the instructor to teach in the other modules. Evaluation Strategy: Continual surveillance of service orders, shop management, customer relations, outgoing jobs, customer evaluation sheets, and the progress chart will be the basis for evaluation.		

Instructional Grouping #24

Time Allotment 90 Hours - Days 204-233 plus 39 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A SERVICING FRONT END ASSEMBLIES (L-1-2)		
Objective: To give the student practical experience in the analysis, repair, replacement and adjustments of varied front and rear suspension units to make the vehicle as near to new road status as is practical.		
Servicing Front End Assemblies:		
1. Make vehicle safety check	204	Safety and Purpose
	205	Components of Suspension
2. Diagnose steering malfunctions	206	Front Suspension Types
3. Remove and replace shock absorbers	207	Ball Joints and King Pins
	208	Terminology of Chassis
4. Remove and replace tie rods	209	Spring Types and Function Modulus of Elasticity
5. Remove and replace drag link	210	Sprung and Unsprung Weight
6. Remove and replace idler arms	211	Geometry and Math Degrees Positive and Negative
7. Remove and replace springs	212	Examination
8. Remove and replace control arms	213	Review

COURSE CONTENT

LABORATORY

9. Remove and replace ball joints
10. Check and adjust caster, various types
11. Check and adjust camber, various types
12. Check and adjust toe-in
13. Check toe-out on turns
14. Remove and replace power steering pumps
15. Remove and replace steering gears

Management Strategy:

Two service bays with frame lifts and front-end equipment and the necessary hand tools will be used. Vehicles will be supplied through customer work requests and routed through the Service Desk.

Four students (two teams) will spend six weeks in this module.

RELATED TECHNOLOGY

214	Elements of Front End Geometry
215	Camber and Effects
216	Caster and Effects
217	Toe-in
218	Akerman Effects and Toe-out on Turns
219	Adjustment Method
220	Alignment Procedure
221	Alignment Diagnosis
222	Wheel Balance Static and Kinetic
223	Shock Absorbers
224	Rear Suspension Types
225	Rear Alignment
226	Examination
227	Steering Gears
228	Power Steering Types
229	Power Steering Gears

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Instructional Strategy: The instructor will give a group demonstration, using the alignment data sheet and the shop manual for reference. Students will then receive various types of customer vehicles, requiring suspension repairs, which they will accomplish with coaching from the instructor or advanced students. Evaluation Strategy: Observation by the instructor during work performance, and close adherence to the alignment specifications as recorded on the Alignment Data Sheet, and checked by the instructor and student service manager will be the basic evaluation. Evaluation sheet and progress chart will supplement the above.		

Instructional Grouping #25

Time Allotment 90 Hours - Days 234-263 plus 45 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A TUNE-UP AND ELECTRICAL (H-1-2-3) (E-1-2)		
Objective: The student will be given a vehicle requiring the diagnosis, repair or replacement of parts and adjustments to return it, as nearly as possible, to factory running specifications. Repairs will be limited to tune-up, tappet adjustments and adjustment or replacement of electrical component.		
Tune-up and Electrical:		
1. Diagnose failure to crank	234	Wire Gauges and Electrical Symbols
2. Make battery tests	235	Electrical Fundamentals Review - Volts, Amps, Ohms
3. Make voltmeter and draw tests	236	Factory Specification Sheet (Tune-up)
4. Make hydrometer tests		Symbol Recognition
5. Diagnose starter circuit	237	Tune-up Procedure
6. Make starter repairs	238	Oscilloscope Patterns
7. Diagnose failure to start	239	Voltmeter Analysis
	240	Dwell Meter and Test Light
8. Make primary ignition checks	241	Types of Spark Advance (See Appendices for Lesson Plan)
9. Make secondary ignition checks	242	Advance Mechanisms

COURSE CONTENT

LABORATORY

10. Make fuel system checks
11. Use voltmeter
12. Use dwell meter
13. Use oscilloscope
14. Use vacuum-pressure gauge
15. Employ various tune-up methods
16. Make compression tests
17. Use distributor strobe
18. Make distributor checks
19. Make carburetor adjustments
20. Overhaul carburetor
21. Test fuel pumps
22. Check D.C. charging systems
23. Check A.C. charging systems
24. Test emission systems
25. Test manifold heat valves

Management Strategy:

Two work stalls with one oscilloscope, distributor tester, timing lights, volt-amp tester and other small

RELATED TECHNOLOGY

243 Spark Plugs and Cross Reference Charts

244 Examination

245 Carburetor Circuit I

246 Carburetor Circuit II

247 Carburetor Troubles

248 Four-Barrel Operation

249 Carburetor Specifications Chart

250 Introduction to Fuel Injection

251 Quiz and Review

252 D.C. Generators

253 D.C. Regulators

254 Trouble Shooting D.C. Systems

255 Alternators I

256 Alternators II

257 Alternators Regulator

258 Quiz and Review - VICA

259 Emission System PCV

260 Emission CAP

261 Emission EGR

262 Duty Examination

263 Review - VICA

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
tools will be used. Vehicles will be supplied from the Service Desk via customer work requests. Four students (two teams of two each) will spend six weeks in this module. Slower students may spend additional time here, while the faster students may have the opportunity for more complex tasks, or be used as student instructors. Instructional Strategy: Small group (four students) demonstrations of basics will be supplemented with coaching as the tasks progress. Step-by-step procedure sheets with check-offs will ensure thoroughness as the students complete the tasks. Advanced students may also be used as instructors. (See Appendices for Lesson Plan) Evaluation Strategy: Students will be judged on capabilities of making repairs conform to factory specifications, ability to work from shop manuals and job sheets and conform to factory suggested repair times. Student service desk and customer evaluation sheets, as well as the progress chart, will be used.		

Instructional Grouping #26

Time Allotment 105 Hours - Days 264-298 plus 52 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A MAJOR ENGINE AND DRIVE LINE (F-1-2-3-4)(M-2)		
Objective: Given a vehicle that requires major engine or drive-line repair, the student will remove the unit, disassemble, clean, evaluate, recondition and/or replace parts to return the unit to near new running condition, as dictated by the factory assembly limits. Quality of repairs with respect to flat-rate times will be grading criteria.		
Major Engine and Drive Line:		
1. Remove engine	264	Review Four-Stroke Cycle
2. Remove accessories	265	Performance Term Definition
3. Remove cylinder head		Horsepower, Torque
4. Disassemble cylinder head	266	Bore, Stroke and Displacement Metric Conversion
5. Grind valves		
	267	Engine Efficiencies
6. Grind seats		
	268	Engine Type Classification by Various Design
7. Test valve springs		
8. Assemble cylinder head	269	Wankel Engines
9. Disassemble short block	270	Engine Block Construction and Nomenclature
10. Recondition cylinder		
	271	Cylinder Heads and Combustion Chambers
11. Inspect piston and rod		

COURSE CONTENT

LABORATORY		RELATED TECHNOLOGY	
12.	Inspect crankshaft	272	Compression Ratio Computation
13.	Inspect valve lifters	273	Seals, Gaskets and "O" Rings
14.	Inspect camshaft	274	Crankshaft Types and Nomenclature
15.	Install camshaft	275	Engine Bearings and Analysis
16.	Install crankshaft	276	Engine Oils and Filters
17.	Time valves	277	Lubricating Systems
18.	Assemble engine	278	Connecting Rod Construction
19.	Install engine	279	Piston Types and Construction
20.	Start new engine	280	Cylinder and Ring Reconditioning
21.	Make final adjustments	281	Valves and Cams
22.	Remove standard transmission	282	Valve Trains and Grinding Angles
23.	Disassemble transmission	283	Computing Valve Duration, Lift and Overlap
24.	Overhaul transmission	284	Possible Mechanical Malfunctions
25.	Assemble transmission	285	Hydraulic Lifters
26.	Remove clutch	286	Examination - VICA
27.	Inspect fly wheel	287	Clutch Purpose and Types
28.	Install clutch	288	Clutch Service
29.	Remove axle shafts and seals	289	Standard Shift Transmissions
30.	Remove differential	290	Gear Ratio Mathematics
31.	Overhaul differential	291	Introduction to Automatic Transmissions
32.	Diagnose automatic transmission	292	Differential Functions

COURSE CONTENT

LABORATORY	RELATED TECHNOLOGY	
33. Adjust automatic transmission externally	293	Standard Differential and Gear Ratios
34. Adjust automatic transmission internally	294	Limited Slip Types
	295	Axles, Bearings and Housings
35. Replace auto transmission filters	296	Diagnosing Differentials
36. Remove and replace auto transmission neutral safety switches and modulators	297	Examination - VICA
	298	Review - VICA

Management Strategy:

One or two work stalls, as required, and the balcony auto machine shop area will be utilized. Valve refacing and reseating equipment, ridge reamer, cleaning tank, grinder, cylinder hone, micrometers, and torque wrenches will be needed. Two teams (four students) will spend seven weeks in this module, working on vehicles supplied to them by the Service Desk and customer work requests.

Instructional Strategy:

This grouping requires relatively few small group demonstrations, but large amounts of work by the students. Removal, disassembly and cleaning will consume large amounts of student time and the instructor may "coach" and check. Shop manuals will play an important

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
part in instruction "how to do it", by listing step-by-step procedures. Small group demonstrations are quite short, but will require large time blocks for the student; i.e., the instructor may demonstrate valve refacing on one valve and the student must complete the other fifteen. Advanced students may act as peer group instructors for developing foremanship. Evaluation Strategy: The instructor will observe the students in performance of duties, as to technique, cleanliness, and ability to work from shop manuals and job sheets. Vehicles will be critiqued by the service desk team, as well as by the instructor. Feedback, by way of customer evaluation sheets, will also be used.		

Instructional Grouping #27

Time Allotment 60 Hours - Days 299-318 plus 30 hours
LAB RELATED

COURSE CONTENT

LABORATORY

LEARNING MODULE A

LUBRICATING AND MAINTAINING VEHICLES (C-1-2)

Objective:

Given a customer vehicle which requires routine lubrication and maintenance tasks that are commonly found in the lubritorium or gasoline station service bay, the student will service, repair and replace units as necessary to insure continued safe and efficient vehicle operation. Services and repairs must be complete and accurate and the vehicle must be clean when ready to return to the customer. Service times should be no more than twice the flat-rate times as listed in the shop manual.

Lubricating and Maintaining Vehicles:

1. Lubricate chassis
2. Change oil in transmission
3. Change filters in engine and transmission
4. Pack wheel bearings
5. Replace wheel bearings and seals
6. Rotate tires
7. Install tires

RELATED TECHNOLOGY

Instructional Day	
299	Lube Room Services and Purpose
300	Greases, Oils and Gear Lubes
301	SAE and API Codes Viscosity Index
302	Engine Oiling System and Filters
303	Tire Sizes and Designation
304	Tire Types and Construction
305	Lights, Fuses and Flashers
306	Engine Cooling Systems and Coolants

COURSE CONTENT

LABORATORY

8. Balance tires
9. Make tire repairs
10. Replace light bulbs
11. Aim headlights
12. Replace flasher unit
13. Replace stop light switches
14. Replace coolant hoses
15. Service accessory drive belts
16. Replace or service water pump
17. Service wiper blades and arms
18. Install antifreeze
19. Replace thermostat
20. Replace heater cores and hoses
21. Replace shock absorbers
22. Repair drive shaft
23. Service battery and cables
24. Repair or replace exhaust system
25. Use oxygen-acetylene torch

RELATED TECHNOLOGY

307	Antifreeze and Mixture Computations
308	Examination
309	Shock Absorbers - Types
310	Drive Shaft and "U" Joints - Types
311	Battery Specifications
312	Battery Cable and Wire Gauges
313	Exhaust Systems Nomenclature
314	Catalytic Converters
315	EGR Systems
316	Air Injection Systems
317	Lube Sticker Completion
318	Examination

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Management Strategy: One lift bay will be used for work that is typical in the lubritorium of the gasoline station. Greasing equipment, gear oil dispensor, oil drain receptacle, lube charts, drain pans, and oxygen-acetylene burning equipment, plus the students' hand tools will be required. Two students will work as a team for four weeks. This area will afford wide experience for the slower learner who cannot do the more complex tasks. He may remain in this area longer to gain the necessary skills. Instructional Strategy: Individual team instruction and supervision will be provided on a task basis. Peer instruction will supplement the instructor and develop foremanship for the advanced students. Evaluation Strategy: The student will be observed by the instructor as to quality and quantity of work in this area. Thoroughness and use of tools will be stressed. Oral questioning, as well as paper and pencil tests, will supplement the progress chart and the customer evaluation sheet.		

Instructional Grouping #28

Time Allotment 60 Hours - Days 319-338 plus 30 hours
LAB RELATED

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
LEARNING MODULE A BRAKES (I-1-2-3) (J-1-2) Objective: Given a vehicle requiring brake service, the student will diagnose, locate and repair trouble in the brake system. He will also service vehicles requiring normal maintenance, such as adjustment and replacement of parts necessary to produce safe, sure and repeated stops. Quality of work will meet industry standards, and repair times should be no more than twice that of standard flat-rate times. Brakes:		
1. Remove and replace brake drums	319	Safety and Responsibility
	320	Brake Terminology
2. Turn brake drums and lathe	321	History of Brakes
3. Remove and replace brake shoes	322	Coefficient of Friction
	323	Construction and Shoe Types
4. Clean backing plates and hardware	324	Duo-servo Brakes
5. Remove and replace wheel cylinders	325	Disc Brake Types, Caliper Design
6. Rebuild wheel cylinders	326	Drums and Rotors - Materials - Sizes
7. Remove and replace brake lines, rigid		Computation of Swept Area

COURSE CONTENT

LABORATORY		RELATED TECHNOLOGY	
8.	Make tubing flares	327	Mechanical Malfunctions
9.	Remove and replace hoses, flexible	328	Examination
10.	Adjust brakes	329	Methods of Brake Actuation
11.	Service parking brake cable	330	Principles of Hydraulics
12.	Remove and replace calipers	331	The Master Cylinder
13.	Remove and replace rotors	332	The Wheel Cylinder
14.	Resurface calipers	333	Brake Fluid, SAE Types
15.	Rebuild calipers	334	Hydraulic Malfunctions
16.	Remove and replace master cylinder	335	Power Brakes - Types
17.	Rebuild master cylinder	336	Power Brakes
18.	Remove and replace stop light switch	337	Parking Brakes
19.	Remove and replace power brake unit	338	Examination
20.	Overhaul power unit		
21.	Test proportioning valve		

Management Strategy:

One work stall with four stand jacks, hydraulic jacks, brake cylinder hone and pressure bleeder, brake drum lathe with rotor attachment, drum gauges and micrometers

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
will be used. One team will work on "live" automobiles supplied by the Service Desk and customer work requests. Instructional Strategy: Students will work in teams on vehicles supplied by the Service Desk. Instructor will "coach" and inspect tasks as activities are completed. Group demonstrations and use of advanced students as foremen will reduce the instructional load. Evaluation Strategy: Instructor inspection of task steps, as well as completed job evaluation by the service desk group and the customer, will be the basis for evaluation. Task progression will be noted on the progress chart and by the accumulation of work orders.		

Instructional Grouping #29

Time Allotment 45 Hours - Days 339-353 plus 22 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY

LEARNING MODULE A

DIAGNOSIS AND SERVICE OF AIR CONDITIONING (Q-1-2)

Objective:

Given a vehicle with an air conditioning malfunction, the student will diagnose and repair the trouble. He will perform routine maintenance and replacement of parts necessary to return the vehicle to industry quality standards, or to the customer's satisfaction.

Diagnosis and Service of Air Conditioning:

1. Handle refrigerant
2. Use manifold gauge set
3. Make operational tests
4. Make leak tests
5. Discharge the system
6. Charge the system
7. Remove and replace the compressor

Management Strategy:

One work stall with gauge manifold set, small hand tools and leak detector torch will be used. One team will work on cars supplied by the Service Desk and customer work requests.

RELATED TECHNOLOGY

Instructional Day	
339	Safety in Air Conditioning
340	Heat and Change of State
341	Refrigerants
342	Air Conditioning Components
343	Compressors and Clutches
344	Quiz - VICA
345	Condensors and Receiver - Drier
346	T.E.V. and Evaporators
347	Complete System Operation
348	System Controls
349	Automatic Temperature Controls
350	Quiz - VICA
351	Operational Tests
352	Service Valve Function
353	System Diagnosis

COURSE CONTENT

LABORATORY	Instructional Day	RELATED TECHNOLOGY
Instructional Strategy: Instruction will be given in small group demonstrations. Advanced students will primarily work in this area and will receive instructor coaching and rely heavily on worksheets and shop manuals. Evaluation Strategy: Evaluation will be made by instructor and student Service Manager inspection of task steps, as well as completed job evaluation by both shop personnel and the customer satisfaction report. Progress charts will be an additional evaluation method.		

Instructional Grouping #30

Time Allotment 21 Hours - Days 354-360 plus 10 1/2 hours
LAB RELATED

COURSE CONTENT

LABORATORY	RELATED TECHNOLOGY	
CLOSE SHOP FOR SUMMER	Instructional Day	
1. Clean shop floor and walls	354	Job Application Methods
	355	Review and Senior Activities
2. Clean and paint shop equipment	356	Senior Activities
	357	Senior Activities
3. Paint stall floor lines	358	Senior Activities
	359	Senior Activities
	360	Senior Activities

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LESSON PLAN

Related Technology

Instructional Grouping #10

Day 73

SUBJECT BATTERY SPECIFIC GRAVITY

Objectives: The student will be able to measure specific gravity accurately, regardless of weather conditions.

Teaching Aids: Overhead transparency

Preparation:
1. Easiest method
2. Most accurate
3. Most common

Presentation:

1. Specific gravity	1. Definition Purpose Function
2. Measuring	2. Proper tool Quality Accuracy
3. Temperature	3. 80°F Variation Correction

Application:

The student will figure the temperature corrected specific gravity readings supplies on a worksheet.

LESSON PLAN

Manipulative

Instructional Grouping #10
Module D

SUBJECT CLEANING BATTERY TERMINALS

Objectives: The student will be able to remove and clean battery terminals without damaging the battery.

Teaching Aids: Battery and cleaning tools

Preparation:

1. Most common cause of no-start
2. Batteries being replaced that are fully charged
3. Losing customers
4. Service

Presentation:

1. Clean battery	1. Cover fenders Baking soda Rinse
2. Remove cables	2. Loosen Spread Never pry or twist
3. Clean post and cable	3. Proper tool Material removed Inspection
4. Replace cables	4. Cable straight Cable tight Never pound

Application:

The student will clean the battery and cables on the automobile assigned to him.

LESSON PLAN

Related Technology

Instructional Grouping #25
Day 241

SUBJECT IGNITION ADVANCE - SPARK LEAD

Objective: Encourage reading and interpreting shop manuals

Teaching Aids: Various distributors, chalkboard or overhead projector

Preparation: Pupil motivation. Reduction of shop errors

Presentation:

Topics	Key Points
Initial	Starting point—expected to change with some outside means
Static	Will not change under any running conditions
Manual	The operator changes spark setting by some mechanical means
Automatic or centrifugal	Changes due to rotational speed only
Vacuum	Changes with variation of manifold vacuum
Venturi vacuum	Changes with carburetor venturi vacuum due to air flow through the carburetor
Total advance	Initial plus centrifugal and vacuum

Application:

Questions will appear on unit test. Students will also use above information in the lab during actual work.

LESSON PLAN

Manipulative

Instructional Grouping #25

Module A

SUBJECT	DISTRIBUTOR STROBE USE

Objectives: The student will properly test a distributor using the stroboscope.

Teaching Aids: Distributor strobe, distributor, tension guage, specification sheet.

Preparation:
1. Only accurate method of distributor testing
2. Distributor advance road to power and economy

Presentation:

1. Check distributor
2. Zero guages
3. Test point resistance and spring tension
4. Test dwell angle
5. Test lobe accuracy
6. Test dwell variation
7. Test centrifugal advance
8. Test vacuum advance

Application:

Student will perform above activities and fill in test report.

Test:

Check that test report figures fall within specifications.

WHEEL ALIGNMENT DATA SHEET

Analysis Sheet

Operators

Make ____________ Model ____________ Year ________

Tire Size ____________ Pressures: LF RF LR RR

Wheel Bearing ________ Left ____________ Right ________

Ball Joints
King Pins ________ Left ____________ Right ________

Tie Rods ________ Left ______ Right ______ Idler ________

Steering Gear ________ Play ______ Bind ______ Adjusted ______

Comments to owner: ______________________________

____

____

____

ALIGNMENT DATA

Camber Limits ________________ Recommended ____________

Actual Camber ________________ Left ______ Right ________

Corrected Camber ________________ Left ______ Right ________

Caster Limits ________________ Recommended ____________

Actual Caster ________________ Left ______ Right ________

Corrected Caster ________________ Left ______ Right ________

Toe-in Before ________ After ________ Recommended ________

Toe-out-on-turns ________________ Left ______ Right ________

MECHANICS EVALUATION CHART

Mechanic ______________________________ Date ______________

Type Car ________________ Stall __________ Repair Order No. ______

The following circles indicate the areas of repair needed:

1. Tune-up
2. Ignition System
3. Carburetor
4. Fuel System
5. Brakes
6. Brakes Hydraulic
7. Exhaust System
8. Charging System
9. Electrical Wiring
10. Front End Alignment
11. Wheel Balance
12. Steering Components
13. Engine Internal
14. Engine External
15. Cooling System
16. Clutch
17. Transmission (Standard)
18. Transmission (Automatic)
19. Drive Shaft
20. Differential Gear
21. Coil Spring
22. Other

Reason for circling the above area(s):

Instructor's Comments:

ASSIGNMENT SHEET

Assignment Sheet No. 3

Research on Specifications

Knowledge is knowing where to find information. Tune-ups must be done to specifications, and "where to find information" is part of the job.

Our tool room has a set of A.E.A. (Automotive Electrical Association) Standards of Adjustment that should be used whenever a tune-up is done.

To acquaint you with these cards, pick five different makes and years. (The tool room attendant should not give the same five cards to more than one student.) Turn in the list with the following information for each of the five vehicles:

1. Spark plugs
2. Firing order
3. Distributor centrifugal advance
4. Maximum voltage regulator setting
5. Fuel pump make and pressure

INFORMATION SHEET

CAUSES OF CARBURETOR MALFUNCTIONS

Some of the more common causes of carburetor malfunctions are listed below:

1. Dirt or other foreign matter in the fuel and air passages.
2. Improper adjustments (float, linkage, choke, idle, etc.).
3. Improper fuel level in fuel bowl.
4. Leakage (fuel, air, vacuum).

DIRT IN THE FUEL AND AIR PASSAGES can be the prime cause of hard starting, rough idle, poor acceleration, and poor overall engine performance, and will be the prime cause of poor gasoline mileage. In many cases, a thorough cleaning of the carburetor will work wonders as far as engine performance is concerned.

IMPROPER ADJUSTMENTS can be the cause of excessive fuel consumption, poor acceleration, flooding, stalling, and all-round poor engine performance, depending upon whether the idle speed is too fast or too slow, or the idle mixture too rich or too lean.

IMPROPER FUEL LEVEL can result in hard hot and cold starting, poor acceleration, flooding or fuel leakage from the carburetor, poor mileage and overall substandard engine performance. Most adjustments can be made in a short matter of time, and without special tools.

ENGINE PERFORMANCE AND THE CARBURETOR can be affected by the three major causes of carburetor malfunctions mentioned above. The engine can help PINPOINT the source of the malfunction and lead to a quick correction of these conditions. In addition, other causes may be attributed to worn or damaged parts.

WHEN AN ENGINE IS HARD TO START . . . . LOOK FOR:

1. Binding or broken choke linkage
2. Fuel or vacuum leaks
3. Improper idle adjustments
4. Sticking or poorly seating fuel inlet needle
5. Incorrect fuel pump pressure

WHEN THE ENGINE IDLES ROUGH . . . . . LOOK FOR:

1. Incorrect idle mixture adjustment
2. High or low fuel level or float setting
3. Idle adjustment needles grooved or worn
4. Power valve sticking
5. Idle air bleeds, air or fuel passages or idle discharge holes restricted
6. Excessive or low fuel pump pressure

WHEN ACCELERATION IS POOR OR IF DURING ACCELERATION, HESITATION IS NOTED . . . . .

1. High or low fuel level float setting
2. Restriction in accelerating pump discharge passage
3. Fuel level ball not seating on acceleration
4. Loose mounting bolts or defective gaskets
5. Malfunctioning discharge check ball
6. Clogged fuel filter
7. Excessively dirty air cleaner element
8. Incorrect pump stroke adjustment
9. Worn throttle shaft
10. Improperly seated throttle plate(s) in throttle bore

EXAMPLE

AUTO MECHANICS I
TEST I—ELECTRICAL

____
Name

1. The acid in a battery is called ______________________________.

   A. Electrolyte
   B. Sulfuric
   C. Lead sulfate
   D. Specific gravity

2. The solution of water and acid should be ______________________.

   A. 60% water - 40% acid
   B. 40% water - 60% acid
   C. 20% water - 80% acid
   D. 80% water - 20% acid

3. How many cells are there in a 6-volt battery? __________________.

   A. 6
   B. 2
   C. 3
   D. 4

4. The cells in a battery are separated by _______________________.

   A. Lead plates
   B. Rubber insulators
   C. No separation
   D. Electrolyte

5. Specific gravity measures the potency of the ___________________.

   A. Acid
   B. Electrolyte
   C. Water
   D. None of the above

6. If your specific gravity reading falls below ________, you should charge your battery.

   A. 1.200
   B. 1.250
   C. 1.175
   D. 1.150

7. For every 10 degrees above 80°F, you should _________ to your specific gravity reading.

   A. Subtract four points
   B. Add four points
   C. Add two points
   D. Subtract two points

Mark + for True -- 0 for False

8. _____ During a light load test, you should crank your starter for 30 seconds.

9. _____ During a high discharge test, you should crank your starter for 30 seconds.

10. _____ Before a specific gravity test, you should crank your starter for 30 seconds.

11. _____ A ground circuit is not necessary if you have an "insulated" circuit.

12. _____ A wide conductor is better than a thin one.

13. _____ A short conductor is better than a long one.

14. _____ An insulator is a material that will conduct current.

15. _____ A volt is a unit of measurement for a quantity of electricity.

16. _____ An ohm is a measurement of electrical resistance.

17. _____ An amp is a unit of electrical pressure.

Fill in the Blanks

18. The power in a starter is increased by ____________________________.

19. The basic concept an electric motor works on is ________________ ____.

20. Battery self discharge comes from ____________________________.

21. Overcharging indicates a faulty ____________________________.

22. The best way to clean a battery is with ____________________________.

23. The conductor in a starter is the ____________________________.

24. The magnetism in a starter is produced by the ____________________.

25. The ratio of most starter drives to the fly wheel is ____________ ____.

26. Testing on the car with the headlights on (10 points)

A. Lights stay bright = open circuit in 1. ____________

2. ____________

3. ____________

B. Lights dim = ______________________________

C. Lights nearly go out = ________________________

Complete the Following (5 points each)

27. What is Ohm's law? ______________________________

____

28. Briefly describe how magnetism makes a starter function.

____

____

____

____

29. Describe in detail the procedure you would advise for servicing and checking a battery.

____

____

____

____

____

EXAMPLE

Name: ____________________

WORKSHEET

(Place in Notebook)

Define the following:

1. Volatility ____________________
2. Vapor Lock ____________________
3. Hydrocarbons ____________________
4. Gasoline Dilution ____________________
5. Volatility Blend ____________________
6. Detonation ____________________
7. Pre-Ignition ____________________
8. Octane ____________________
9. Knocking ____________________
10. Heat of Compression ____________________
11. Rate of Flame Propagation ____________________
12. Compression Ratio ____________________
13. Iso-Octane ____________________
14. Heptane ____________________
15. Surface Ignition ____________________
16. Ethyl ____________________
17. Tetraethyl Lead ____________________
18. Ethylene Dichloride ____________________
19. Turbulence ____________________
20. Squish ____________________
21. Quench Area ____________________

To: Auto Mechanics I Students

From: Mr. William G. Pearce, Vocational Director

Subject: Auto Tools - Junior Set

In order for us to purchase the tools you will need for Auto Mechanics I, we must place the order before ____________________. Our supplier has informed us that he can no longer make up individual sets. You must either purchase the entire set from him, or make up your own set from other sources. The school price for the entire set is $____________, payable on the first day of school, and includes the following:

3/8" DR. SET IN BOX
9 STD. SOCKETS, 3/8" THRU 7/8"
8 DEEP SOCKETS, 3/8" THRU 12/16"
2 EXTENSIONS, 1 1/2" & 3"
1 RATCHET
1 UNIVERSAL JOINT
COMBINATION WRENCH SET
  9 COMBINATION WRENCHES, 1/4" THRU 3/4"
13/16" SPARK PLUG SOCKET
5/8 " SPARK PLUG SOCKET
SET OF SCREWDRIVERS, 7 PC.
PHILLIPS SCREWDRIVERS
CHANNELLOCK WATER PUMP PLIERS 9 1/2" LONG
CHANNELLOCK DIAGONAL CUTTER 7"
CHANNELLOCK SLIP JOINT PLIER 6"
CHANNELLOCK NEEDLE NOSE PLIER 6"

VICE GRIP 10"
16 OZ. BALL PEIN HAMMER
FEELER GAUGE 25 BLADE
WIRE SPARK PLUG FEELER GAUGE
FLAT CHISEL 3/8
FLAT CHISEL 1/2
18 PC. ALLEN WRENCH SET
4 PC. IGNITION SET IN TOOL KIT
SCREW STARTER W/MAGNET
CHISEL BLADE PUTTY KNIFE
6" RULE
DRILL SET 1/16" THRU 1/4"
EASY OUT SET
SET OF 4 SPARK PLUG EXTENSIONS
POINT ADJUSTING TOOL

TOOL BOX W/TOTE TRAY

Please indicate on this sheet whether or not you wish to order a tool set, sign your name, and return this sheet to the Vocational Office as soon as possible, but not later than ________________. If we have not heard from you by that date, we will not order a tool set for you.

____ I will purchase the tool set from the school
____ I will purchase the set from other sources

____
Signature

To: Auto Mechanics II Students

From: Mr. William G. Pearce, Vocational Director

Subject: Auto Tools—Senior Set

In order for us to purchase the tools you will need for Auto Mechanics II, we must place the order before __________. Our supplier has informed us that he can no longer make up individual sets. You must either purchase the entire set from him, or make up your own set from other sources. The school price for the entire set is $__________ and includes the following:

DEEP SOCKET 1/2" DRIVE, 12 POINT: 1/2", 9/16", 5/8", 11/16", 3/4", 13/16", 7/8", and 15/16"
ADAPTOR, 3/8 to 1/2
3/8" DR. EXTENSION 18"
3/8" DR. SPARK PLUG RATCHET
TEST LIGHT
REMOTE CONTROL STARTER
HOSE CLAMP PLIERS
TIRE GAUGE
BRAKE SPRING REMOVER
BRAKE SPOON
BRAKE SPRING TOOL
COMBINATION 13/16
COMBINATION 7/8
COMBINATION 15/16
1/2" DRIVE SOCKET SET (16 PC.) 13 SOCKETS, EXTENSION, FLEX AND RATCHET

Please indicate on this sheet whether or not you wish to order a tool set through the school, sign your name, and return this sheet to Mr. Collier as soon as possible, but not later than ____________________. If we have not heard from you by that date, we will not order a tool set for you.

____ I will purchase the tool set from the school
____ I will purchase the tool set from other sources

____
Signature

AUTO MECHANICS
CUSTOMER EVALUATION SHEET

In order to become a proficient auto mechanic, the student must learn to evaluate and correct his mistakes. Your evaluation and comments of the repair work done on your automobile will be helpful. Please complete the return this form. If there is a major problem, please contact us immediately.

STUDENT WORKMANSHIP

	Satisfactory	Unsatisfactory
Tire Rotation or Mounting		
Tire Balancing		
Wheel Alignment		
Lubrication		
Carburetor		
Steering System		
Air Conditioning		
Exhaust System		
Brake System		
Motor Tune-up		
Shock Absorbers		
Transmission		
Grinding Valves		
Other		
Condition of Car Interior		
Condition of Car Exterior		
Student-Customer Attitude		
Teacher-Customer Attitude		

Length of time car was in for repair ______________________

Suggestions - Comments:

Name ______________________ Address ______________________

Date ______________________ ______________________

BROOKLYN HIGH SCHOOL

AUTOMOTIVE POLICY STATEMENT

Due to the educational process involved in the Brooklyn High School Automotive class, it is sometimes difficult to give quick and efficient service. Please bear in mind that time is necessary for quality workmanship. Work accepted is done by students for educational purposes. WE CANNOT BE HELD TO A TIME LIMIT FOR ACCEPTANCE OR COMPLETION OF AUTOMOBILE.

POLICY AND PROCEDURE FOR WORK REQUESTS

1. An application for repair must be filled out by the owner of the vehicle. The application may be secured from the elementary principals' offices or the vocational office.

2. Owner will be notified when to bring the car to automotive garage. Work will be performed by appointment only.

3. Top priority will be given to work in the present area of instruction. Other work will be on the first come, first served basis.

4. Owners are to park their cars in a double file in front of the East door of the automotive area.

5. Keys are to be delivered to an automotive student.

6. It is the owner's responsibility to understand the financial obligations before leaving the car.

7. Cars will not be released until payment is received in vocational office.

8. Payments to be received in the vocational office from 10:00 to 12:00 a.m. and from 1:00 to 3:45 p.m.

9. All work will be performed only by vocational automotive students.

10. Parts to be supplied by school at wholesale cost plus 20%.

DEPARTMENT OF VOCATIONAL EDUCATION
BROOKLYN HIGH SCHOOL

APPLICATION FOR WORK TO BE DONE IN AUTOMOTIVE DEPARTMENT

Name ______________________ Address ______________________

Phone ______________________ City ______________________

Make of Car __________ Year ____ Color ________ License __________

CHECK THE SERVICES YOU WANT PERFORMED

- __ Tire Rotation 75¢
- __ Tire Mounting 25¢ per wheel
- __ Tire Balancing $1.00 a wheel (including weights)
- __ Wheel Alignment $2.00
- __ Front Wheel Bearing Lubrication 50¢
- __ Clutch Adjustment 50¢
- __ Pack Universal Joints 50¢
- __ Check Carburetor
- __ Check Power Steering
- __ Steam Clean Engine $2.00
- __ Check Air Conditioning
- __ Replace Exhaust System if necessary
- __ Dynamometer Inspection (automotive diagnosis) $4.00
- __ Brake Adjustment 50¢
- __ Motor Tune-up
- __ Check Electrical System (specify) ____________
- __ Anti Freeze
- __ Oil Change 60¢ per quart
- __ Oil Filter
- __ Lubrication
- __ Air Filter
- __ Replace Front Shock Absorbers if necessary
- __ Replace Rear Shock Absorbers if necessary
- __ Replace Front Brake Lining if necessary
- __ Replace Rear Brake Lining if necessary

Additional Work to be Done ______________________________

____

____

Owner to be notified if repairs will exceed $ ______________

I hereby authorize the above repair work to be done along with the necessary material, and grant permission to have the car operated for the purpose of testing and/or inspection. By law, the Board of Education assumes no responsibility for fire, theft, or damage to the automobile or its contents.

Date ________________ ______________________

Applicant's Signature

- -

Applicant notified to bring in car on: ____________________
Date

EXAMPLE: Breaking down an instructional Grouping for Course Content

DUTY: Overhaul Carburetor 30 Hours - 10 Days

OBJECTIVE: Given a carburetor of any size or make, the student will be able to overhaul that carburetor, identify all of the major parts and circuits, and have it function on an engine according to manufacturers' specifications.

STRATEGIES: The instructor will spend the first day of this module giving a total group demonstration. The students will then be required to overhaul a one-barrel, two-barrel, and four-barrel carburetor. There will be enough carburetors available for each student to work individually. Upon completion of these three carburetors, the students will overhaul the carburetor on their own engine in the Junior Engine Overhaul area of the shop, and make it function according to trade-accepted standards.

BREAKDOWN OF INSTRUCTIONAL GROUPING FOR COURSE CONTENT

TOOLS AND MATERIALS	STEPS	SKILLS	SAFETY	SCIENCE	MATH	COMMUNICATIONS	OTHER
20 one-barrel carburetors	Remove carburetor	Use of proper tools	Use of gasoline	Gasoline composition	Fractional calibrations	Reading specifications	Oil industry
20 two-barrel carburetors	Dismantle carburetor	Cleaning techniques	Proper use of carburetor cleaning acid	Fuel flow	Cubic feet per minute	Reading test equipment	Octane rating
20 four-barrel carburetors	Clean carburetor			Inspection theory			Gasoline additives
10 live engines with carburetors	Overhaul carburetor	Circuit adjusting	Use of fire extinguishers	Diesel theory	Ratios	Terminology	
10 carburetor overhaul kits	Adjust carburetor to specs	Emission analyzing		Venoulli theory	Venturi area		Carburetor rebuilding as a career
5 gallons of gasoline							Jet measurement
student hand tools	Install carburetor	Use of vacuum gauge	Backfiring carburetor	Atmospheric pressure			
5 gallons of carburetor cleaner	Adjust air-fuel ratio	Use of float level gauges	Air cleaners	Vacuum Chemical symbols			Number drill sizes
	Adjust idle						